A SYSTEM OF SURGERY,

BY

J. M. CHELIUS.

TRANSLATED FROM THE GERMAN

BY

JOHN F. SOUTH.

VOL. I.

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A

SYSTEM OF SURGERY,

BY

J. M. CHELIUS,

DOCTOR IN MEDICINE AND SURGERY, PUBLIC PROFESSOR OF GENERAL AND OPHTHALMIC
SURGERY, DIRECTOR OF THE CHIRURGICAL AND OPHTHALMIC CLINIC
IN THE UNIVERSITY OF HEIDELBERG,
&c. &c. &c.

TRANSLATED FROM THE GERMAN,

AND

ACCOMPANIED WITH ADDITIONAL NOTES AND OBSERVATIONS,

BY

JOHN F. SOUTH,

LATE PROFESSOR OF SURGERY TO THE ROYAL COLLEGE OF SURGEONS OF ENGLAND,
AND ONE OF THE SURGEONS TO ST. THOMAS'S HOSPITAL.

VOL. I.

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TO

JOSEPH HENRY GREEN, F.R.S.
PROFESSOR OF ANATOMY TO THE ROYAL ACADEMY,
AND
SENIOR SURGEON OF ST. THOMAS'S HOSPITAL,

THIS WORK

IS INSCRIBED,

AS A TESTIMONY

TO HIS HIGH PROFESSIONAL AND MORAL WORTH,

AND

WITH CHERISHED REMEMBRANCE OF A WARM AND STEADY FRIENDSHIP,
UNDER MANY TRYING CIRCUMSTANCES,

DURING MORE THAN THREE AND THIRTY YEARS,

BY

HIS AFFECTIONATE FRIEND AND COLLEAGUE,

JOHN F. SOUTH.

Blackheath Park, 1847.

AUTHOR'S PREFACE TO THE FIRST EDITION.

THE object I had in view in the production of the present work was a short and clear description of Surgical Diseases and their Treatment; in which I have endeavoured, as far as possible, to point out the best works both of these and foreign countries. According to the plan of this book, many things are slightly treated of, and many only hinted at, which will be enlarged on in my oral lectures.

I must not be blamed for having omitted Diseases of the Eye and Ear; for Ophthalmic Surgery has attained so great importance as to require a special treatise; and, like many other Teachers, I deliver a separate course of Lectures on Diseases of the Eye and Ear.

Heidelberg, November 1821.

PREFACE TO THE FIFTH EDITION.*

THE short space of time in which a new Edition has become necessary, (although the fourth consisted of above two thousand copies,) and the translations of it which have appeared in seven different languages, are such honourable and pleasing testimonies of the continued favourable reception of this book, that I have, with the greatest diligence, endeavoured to enlarge and improve it, in correspondence with the present state of Surgery. The last six years have been specially fruitful in important events throughout the whole realm of Surgery, and I trust I have not overlooked anything of consequence. To M. PIGNÉ, I must offer my best thanks for the many additions he has made to his French translation.

Heidelberg, June 1839.

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* Second Edition, Dec., 1825; Third Edition, April, 1828; Fourth Edition, April, 1833.

PREFACE TO THE SIXTH EDITION.

ALTHOUGH from the extremely short space of time which has rendered a sixth edition of this Handbook necessary, very numerous additions and alterations cannot be made, yet I hope, by much improvement, to have increased its utility. May it still continue to merit the favourable reception it has hitherto enjoyed.

CHELIUS.

Heidelberg, *August*, 1843.

TRANSLATOR'S PREFACE.

It is a common practice in the German Medical Schools for the Teacher to publish a Textbook on the subject of which he treats, and, taking this with him into the Class-room, to enlarge upon it, and thus form his lecture. This is the reason why, in the work of Chelius, many things are but slightly noticed, and some only hinted at, which seem worthy of being fully and completely detailed.

Had I confined myself to a mere translation of my original, many important points must have been omitted, and the object for which I undertook the publication of the Handbook could not have been attained. I was therefore obliged to resort to annotations and comments, the result of my own experience and reading, for the purpose of filling up and enlarging the Author's short notices, so as to render them more generally useful both to the student and the practitioner. In doing this I have far exceeded the limits I had originally proposed to myself, but the subject is so important, and fresh matter was so constantly at hand, that my great difficulty has been in restricting my work within its present bounds.

My first object in undertaking this task was to render Surgeons in this country more conversant with foreign practice than they had hitherto been. French Surgery, with its showy, but sometimes too hazardous operations, had indeed been pretty well known among us ever since the peace of 1815, soon after which, medical students, with other British visitors, flocked in crowds to the French capital. But of the Surgery of the German Schools very little had been known in England until within the last few years, no standard German book having appeared in English since the publication of Heister's valuable work a century ago.

Several years since, when I was preparing to deliver Lectures on Surgery at St. Thomas's Hospital, (soon after commencing which, severe illness forced me to resign my appointment,) I was thankful for the great assistance I derived from becoming acquainted with CHELIUS's excellent *Handbuch der Chirurgie;* and as I grew more familiar with the work, it appeared to me that a translation of it would present to my countrymen a fair and satisfactory view of the important services which our German brethren have rendered to Surgery. Still, however, I felt it would be necessary to add notes of my own, for the purpose of explaining and discussing occasional, and sometimes important, differences in the practice of the German and English Schools. In doing this I trust I have fairly stated the arguments on both sides, and shown on what grounds I have decided between them.

I shall be charged, I fear, with having buried my Author beneath a mass of notes and comments. They are indeed numerous, and they might occasionally have been made shorter, had I condensed, in my own words, the opinions of the authors I have cited. To this practice, however, though not uncommon, I am utterly opposed. The meaning of a writer ought to be best set forth in his own words, and if others attempt to convey his meaning briefly, they not unfrequently fail to declare his opinions, or they altogether misrepresent them. I have, therefore, with but few and unimportant exceptions, quoted the statements of authors in their original words. I have also, as far as possible, endeavoured to award to the originators of new modes of practice, their just meed of credit; and if, as may occasionally have happened, I have passed by unnoticed any of the leading Surgical writers of the British Schools, I hope on a future opportunity to repair my seeming inattention.

To Professor CHELIUS, with whom I communicated previously to the commencement of my publication, my best thanks are due, for his kindness in furnishing me with the several parts of his new edition, at the earliest opportunity. I trust he will be gratified with the pains I have taken to place him in a condition to be estimated as he truly deserves to be by British Surgeons, and to make his work a stock book in English Surgical Literature.

I have also to thank many kind friends who have furnished me with information which has been of great use to me, and which I could not otherwise have obtained. But to none am I more deeply indebted than to my able and excellent friend **James Dixon**, Surgeon to the London Ophthalmic Hospital, and lately Demonstrator of Anatomy in St. Thomas's School, for his ready and constant assistance during the whole course of this work; and it is with much pleasure that I take this opportunity of offering my testimony to his high professional talent and private worth.

Before I conclude, it is but justice to my Publisher to acknowledge his liberality in allowing me entirely to control and conduct this work, according to my own views, no less than his readiness in undertaking, solely on my recommendation, the publication of a book, which, although well known and estimated abroad, was almost new to English Surgeons, and could only be brought out, in the manner I desired, at considerable risk and expense. To him, therefore, is due in part the appearance of this *eighth translation* of Chelius's Handbook, since without his assistance it would probably have never seen the light.

I know not whether to consider it a matter of gratulation, that a reprint of my translation has been begun at Philadelphia. Nine numbers have already appeared, without any communication having been made with my publisher, although he had offered to furnish an edition for the American market before the forms were broken up. I must at least feel gratified that my Author's celebrity has reached to the western hemisphere: it will be extended to India, in a way more satisfactory to my publisher, through the munificence of the Directors of the Honourable East India Company.

John F. South.

Blackheath, February, 1847.

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INTRODUCTION.

I.

DEFINITION OF SURGERY.—ITS RELATION TO THE HEALING ART IN GENERAL.—DIVISION OF SURGICAL DISEASES.

ALL diseases to which the animal organism is exposed, are the object of the science of healing, the purpose of which is their *prevention, cure, or alleviation.* The means we employ to these ends are either *dietetic* or *pharmaceutic*, or they consist in the *application of suitable mechanism,* which we call *surgical means,* and the doctrine of their proper employment, which is called *surgery.*

Every mechanical influence employed with skill upon the diseased organism is called a *surgical operation.* This influence consists either in a direct interference with the form and natural connexion of the part (*Bloody operations,* Akiurgie (*a*), Germ.); or only in a momentary or continued application of mechanism fitted to the surface of our bodies; to which belong *bandages* and *machines,* simple manipulations for restoring the natural position of parts, and the employment of suitable mechanism for repairing parts which have been destroyed (*Kosmetik* (*b*), Germ.)

There are diseases which specially require the employment of one or other class of the means just mentioned: the purpose, however, of the healing art is in most cases but imperfectly attained, if the medical man be not possessed of the requisite knowledge for deciding upon the necessary connexion of these means, so as properly to conduct their operation by a sufficient acquaintance with the laws of our organism, whence it necessarily follows that there cannot be established any true separation between the so-called *medical* and *surgical* treatment.

The employment of surgical means calls for peculiar dexterity and aptness which natural talents and disposition and long practice can alone confer. "*Esse autem chirurgus debet,*" says CELSUS (*c*), "*adolescens, aut certè adolescentiæ propior, manu strenuâ, stabili nec unquam intremiscente, eâque non minus sinistrâ quam dextrâ promptus, acie oculorum acri clarâque; animo intrepidus, immisericors, sic, ut sanari velit eum, quem accepit, non ut clamore ejus motus, vel magis, quam res desiderat, properet, vel minus, quam necesse est, secet; sed perinde faciat omnia, ac si nullus ex vagitibus alterius affectus oriretur.*" Only in reference therefore to the physical and psychical characters of the medical man, can there be any division in the practice of medicine and surgery: in their attainment they cannot be separated, and, by the union of medical and surgical study alone, can the foundation be destroyed upon which so much bungling, and so many practices unworthy of the spirit of high art, have hitherto been supported.

(*a*) Ἀκὴ, the edge of a knife; ἔργον, an operation.

(*b*) Κοσμέω, to set in order.

(*c*) De Medicinâ, præf. ad lib. vii.

The study and practice of Surgery are connected with great difficulty. The dexterity and exactitude with which surgical operations must be performed, can only be attained by long practice on the dead body, the opportunity for which is rare; and still rarer the perseverance necessary to overcome the various disagreeables therewith connected. How much does this practice on the dead body still leave imperfect when we have to meet operations on the living! In how many instances does the life of the patient depend momentarily on the hand of the operator; the restlessness of the patient, his cries, a peculiar sensation to which no practitioner is a stranger in operating on the living subject, and particularly in the beginning of his career, easily disturb his needful equanimity, render him anxious and incapable of perfecting his work with firmness and certainty. Therefore are we not surprised on reading the open confession of the great **Haller.** "*Etsi chirurgiæ cathedra per septemdecim annos mihi concredita fuit, etsi in cadaveribus difficillimas administrationes chirurgicas frequenter ostendi, non tamen unquam vivum hominem incidere sustinui, nimis ne nocerem veritus.*"

In the employment of surgical means the practitioner can only be guided by the most perfect anatomical knowledge. That knowledge of the structure of our body, with which the general practitioner is content, is insufficient for the operator. He must be most intimately acquainted by careful dissection with the position of every part, its relations to others, and the variations which in this respect may occur, so that this definite knowledge may direct him in every moment of an operation. Mere descriptive anatomy is not sufficient for the surgeon without that comparative anatomy which is directed to physiology, and which has in view the early developmental periods of the several organs, by which alone a true insight into the nature of so many diseases is possible.

All these difficulties connected with the acquirement and practice of Surgery, are sufficiently rewarded by the great superiority which, on the other hand, the practice of them offers. In most cases where surgical assistance is necessary, the possibility of preserving the patient depends upon it: we must, therefore, in desperate cases take bold measures, and the advance of Surgery within the last few years in this respect, has raised our astonishment at the heroism of art, as well as at the immeasurable resources of nature. In this point of view has **Marcus Aurelius Severinus** most correctly entitled his book on surgical diseases, *De Medicinâ Efficaci.*

The inadmissibility of dividing Medicine from Surgery is most palpable, when we endeavour to determine the object of the latter, and the diseases comprehended within its boundaries, as it never can have a perfectly determined limit in opposition to the other. All diseases which are cured by the application of mechanical means have been called surgical diseases, a definition at once too narrow and too comprehensive, as many so-called medical diseases are removed only by the application of surgical means, and many diseases are evidently within the jurisdiction of Surgery, which very often can be cured only by internal or external pharmaceutical means. The distinction between external and internal diseases, which has been established as the ground of division between Surgery and Medicine, is entirely without meaning.

Let us endeavour to find out some general characters of disease which to a certain extent might legally serve as the law for a nosological division, and to distinguish those diseases to which we would assign the name of surgical.

As the phenomena of life present to us by the relative predominance of *powers and organs*, a *dynamic*, *potential*, and *organic material phase*, on the intimate harmony of which health depends, so do we observe also in the diseased states of the organism, that sometimes the power, sometimes the organ, varies more from the natural type, whence arises the difference between *dynamic* and *organic diseases*. This distinction can, however, only indicate a relatively predominant suffering of one or other phase of life, since the organic body presents in itself an entire whole, of which the several parts and phenomena are in the closest mutual connexion with each other.

The organic diseases are especially those which originate in a destruction of the natural condition, form, and structure of organized tissues, and therefore may generally depend, 1. *on the disturbance of organic connexion*; 2. *on the unnatural union of parts*; 3. *on the presence of foreign bodies*; 4. *on the degeneration of organic parts, or on the production of new structures*; 5. *on the entire loss*; and, 6., *on the superfluity of organic parts*.

Organic diseases must be distinguished into such as have their seat in parts inaccessible to mechanical contrivances, and to our organs of touch, and whose cure therefore can only be attempted by dietetic and pharmaceutic remedies, or whose seat permits the employment of external means and regulated contrivances, and which in most cases can be brought to heal only by these contrivances, with the assistance of dietetic and pharmaceutical aids. *We may therefore distinguish as belonging to the province of Surgery all those organic diseases which have their seat in parts accessible to our organs of touch, or which allow of the employment of mechanical means for their cure.*

Although inflammation is excluded from this general definition, we must, however, still enumerate it generally, and particularly among the manifold origins of surgical diseases, when it attacks external parts. Inflammation in its course and results produces for the most part organic changes, and requires, when attacking external parts, almost always the employment of the so-called surgical means: further, among the surgical diseases soon to be more particularly described, there is not one of which the cause is not inflammation, which in its course does not produce inflammation, or the cure of which is not to a certain extent singly and alone possible by inflammation.

After these observations, we therefore prefer the following division for the setting forth of surgical diseases, which, if it be open to many objections, is, however, an arrangement of diseases according to their internal and actual agreement:—

I. Division.—*Of inflammation.*

1. *Of inflammation in general.*
2. *Of some peculiar kinds of inflammation.*
    a. Of erysipelas; *b.* Of burns; *c.* Of frost-bite; *d.* Of boils; *e.* Of carbuncle.
3. *Of inflammation in some special organs.*
    a. Of inflammation of the tonsils; *b.* Of the parotid gland; *c.* Of

the breasts; *d.* Of the urethra; *e.* Of the testicle; *f.* Of the muscles of the loins; *g.* Of the nail-joints; *h.* Of the joints, viz.
a. of the synovial membrane; b. of the cartilages; c. of the joint-ends of the bones, viz., *aa.* in the hip-joint; *bb.* in the shoulder-joint; *cc.* in the knee-joint; and so on.

II. DIVISION.—*Diseases which consist in a disturbance of physical connexion.*

I. *Fresh solutions of continuity.*
  A. Wounds; B. Fractures.
II. *Old solutions,*
  A. Which do not suppurate, viz.
    a. False joints; *b.* Hare-lip; *c.* Cleft in the soft palate; *d.* Old rupture of the female perineum.
  B. Which do suppurate, viz.
i. *Ulcers.*
  1. In general.
  2. In particular.
    a. Atonic; *b.* Scorbutic; *c.* Scrofulous; *d.* Gouty; *e.* Impetiginous; *f.* Venereal; *g.* Bony ulcers or caries.
ii. *Fistulas.*
  a. Salivary fistula; *b.* Biliary fistula; *c.* Fæcal fistula and artificial anus; *d.* Anal fistula; *e.* Urinary fistula.
III. *Solutions of continuity by changed position of parts.*
  1. Dislocations; 2. Ruptures; 3. Prolapses; 4. Distortions.
IV. *Solutions of continuity by unnatural distension.*
  1. In the arteries, aneurisms; 2. In the veins, varices; 3. In the capillary-vascular system, telcangiectasis.

III. DIVISION.—*Diseases dependent on the unnatural adhesion of parts.*

1. Anchylosis of the joint-ends of bones; 2. Growing together and narrowing of the aperture of the nostrils; 3. Unnatural adhesion of the tongue; 4. Adhesion of the gums to the cheeks; 5. Narrowing of the œsophagus; 6. Closing and narrowing of the rectum; 7. Growing together and narrowing of the prepuce; 8. Narrowing and closing of the urethra; 9. Closing and narrowing of the vagina and of the mouth of the womb.

IV. DIVISION.—*Foreign bodies.*

1. *Foreign bodies introduced externally into our organism.*
  a. into the nose; *b.* into the mouth; *c.* into the gullet and intestinal canal; *d.* into the wind-pipe.
2. *Foreign bodies formed in our organism by the retention of natural products.*
  A. Retentions in their proper cavities and receptacles.
    a. Ranula; *b.* Retention of urine; *c.* Retention of the fœtus in the womb or in the cavity of the belly (Cæsarean operation, section of the pubic symphysis, section of the belly).
  B. Extravasation external to the proper cavities or receptacles.
    a. Blood swellings on the heads of new-born children; *b.* Hæmatocele; *c.* Collections of blood in joints.

3. *Foreign bodies resulting from the accumulation of unnatural secreted fluids.*
   a. Lymphatic swellings; *b.* Dropsy of joints; *c.* Dropsy of the bursæ mucosæ; *d.* Water in the head, spina bifida; *e.* Water in the chest and empyema; *f.* Dropsy of the pericardium; *g.* Dropsy of the belly; *h.* Dropsy of the ovary; *i.* Hydrocele.
4. *Foreign bodies produced from the concretion of secreted fluids.*

V. Division.—*Diseases which consist in the degeneration of organic parts, or in the production of new structures.*

1. Enlargement of the tongue; 2. Bronchocele; 3. Enlarged clitoris; 4. Warts; 5. Bunions; 6. Horny growths; 7. Bony growths; 8. Fungus of the dura mater; 9. Fatty swellings; 10. Encysted swellings; 11. Cartilaginous bodies in joints; 12. Sarcoma; 13. Medullary fungus; 14. Polyps; 15. Cancer.

VI. Division.—*Loss of organic parts.*

1. *Organic replacement of already lost parts*, especially of the face, according to the Tagliacozian and Indian methods.
2. *Mechanical replacement:* Application of artificial limbs, and so on.

VII. Division.—*Superfluity of organic parts.*

VIII. Division.—*Display of the elementary management of surgical operations.*

General surgical operations: Bleeding, cupping, application of issues, introduction of setons, amputations, resections, and so on.

II.

HISTORICAL SKETCH OF SURGERY.

First period...	to the time of Hippocrates.
Second period.	from Hippocrates to Galen.
Third period..	from Galen to the fifteenth century.
Fourth period.	the sixteenth century to the middle of the seventeenth.
Fifth period..	the second half of the seventeenth century to the present time.

The origin of Surgery is founded on the relation of man to external nature, and on his disposition to alleviate the sufferings of his fellow men. In ancient Egypt and Greece the history of Surgery lies in darkness, and it begins in a special sense with Hippocrates, who collected the previously scattered facts, arranged them, and published rational views, drawn from his own experience. It appears from his writings—*καθ' ἰητρεῖον*—*περὶ αγμῶν*—*περὶ τῶν εν κεφαλῆ τρωματων*—*περὶ ἄρθρων*—*περὶ ἑλκῶν*—*περὶ ϛυρεγγῶν*—that he was acquainted with a copious apparatus of instruments and bandages, and several operations exhibit an actual technical tendency. In different parts of his Aphorisms he treats of surgical subjects.

In the Alexandrian school Surgery became more prominent, as it rested on its proper basis, anatomy. Erisistratus and Herophilus made the first examinations of human bodies. We know of their followers and their performances only from subsequent writers

Aurelius Cornelius Celsus is the sole writer after Hippocrates (a period of 400 years intervening between them.) Although Celsus lived at Rome, his writings for the most part belong to the Greeks. In his seventh book he specially treats of surgical operations. After Celsus deserve to be mentioned Soranus, Archigenes, and Rufus.

Claudius Galenus, born A.D. 131, lived at Rome under the Emperor Marcus Aurelius: such of his writings as treat of Surgery are, for the most part, commentaries on those of Hippocrates—as his *'Υπόμνηματα τρία εἰς τὸ βιβλιον 'Ιπποκράτους κατ' ἰητρεῖον—αὐτα περὶ ἀγμῶν—ὑπόμν. τέσσαρα ἄρθρων—ὑπόμν. εἰς τοὺς ἀφορισμους.* Besides which also his own Treatises, *περὶ τῶν ἐπιδεσμων—περὶ βδέλλων, ἀντιϛπάσεως; σικὺας, και ἐγχὰράξεως καὶ καταϛκασμου—περὶ τῶν παρὰ φὺσιν ὂγκων*—and *θεράπευτικης μέθοδου βιβλίον·* After Galenus there is a complete stand-still, and up to the sixteenth century there are but few writers: Oribasius, Aetius, Alexander of Tralles, and Paulus of Ægina.

With the fall of the Roman Empire and the invasion of the Arabs, came a period of darkness and barbarism. We find Surgery, at this time, in the hands of the Arabian physicians, characterized by the neglect of anatomy, with a copious instrumental apparatus, fear of the knife, and frequent employment of the cautery iron. The most remarkable men of this period were Ebn Sina and Abulcasem.

The practice of Medicine and Surgery was, during this time, in Christian Europe, in the hands of the clergy, and sank down to such imperfection, that the knowledge of operations, possessed by the Greeks, was no longer to be met with. In the twelfth and thirteenth centuries, indeed, art and science raised themselves by the foundation of literary institutions; but, as their most special object was the education of ecclesiastics, there was little gain to Surgery. The latter was, at a subsequent period, completely separated by two decrees of the Pope from Medicine, and the priests were forbidden *every bloody* operation on pain of excommunication. At this time arose the barbery system, under which the barbers of the priests were employed by them for the performance of the lesser operations of Surgery. In Italy alone was there yet any striving towards improvement, and Surgery still partially remained in the hands of better practitioners.

In the year 1311 Pitard, of Paris, collected the Surgeons into a company, which formed itself into a college; but, owing to the long-continued disputes with the medical faculty, and without advance in anatomy, Surgery remained in its restricted condition.

[During a large portion of the fourteenth century flourished in England John of Arden, who was born in 1307, and certainly lived till after 1377, as, in a manuscript (MSS. Sloane, No. 75, in Brit. Mus.) which, he says, "propriâ manu meâ exaram," he declares himself 70 years old, "regni regis Richardi 2^{di} primo." From examination of his works, written in Latin, several manuscripts of which, together with many English translations in MSS. of the whole or part of his works, are in the library of the British Museum and in the Bodleian Library at Oxford, it is probable that he did not know much about anatomy, though perhaps he was not more ignorant than his contemporaries. But he was certainly an attentive observer and a careful recorder of what he saw. He wrote specially upon anal fistula, which was translated by **Read** in 1588, and also a Practice of Surgery, in which, among other things, he speaks of sores on the penis, also of gonorrhœa, and describes what is to be done when a stone gets into the urethra. From the number of manuscripts and translations it is quite evident he was long held in great repute by his countrymen, and his works are quite equal and much more original than those of surgical writers of the early part of the sixteenth century. It is much to be regretted that the several manuscripts have not hitherto been collated and published, as they present an excellent view of the state of Surgery in England at this period.—J. F. S.]

With **Guido de Chauliaco** (who lived at Avignon) first commenced a period of independent exertion and reference of Surgery to the basis of anatomy.

[In 1542 the Surgeons, who had previously existed in London as one if not two distinct bodies or brotherhoods, were united without any very good reason beyond, perhaps, **Henry the Eighth**'s pleasure, by act of Parliament, to the Barbers' Company of London; but they were only paired, not matched, as it appears that their Court of Assistants was equally divided between the two professions, the Barbers having their side, the Surgeons theirs, but neither interfering with the other's department. This Act of Parliament encouraged dissection by directing that "the masters or governors of the said mystery" should have, "at their free liberty and pleasure," the bodies of four felons, "to make incision of the same * * * for their further and better knowledge, instruction, insight, learning, and experience in the said science or faculty of Surgery." From the destruction of the books it cannot be ascertained whether dissection was forthwith pursued; but, in 1566, public demonstrations and dissections were enacted by the Company of Barbers and Surgeons to be held in their hall at stated periods, and conducted by two masters and two stewards of the "anathomies." There was also a readership of anatomy at the hall, which was long held by physicians appointed by the Court of Assistants, but when instituted is doubtful. **Wadd** says that Dr. **William Cunningham** lectured there in 1563; but the first appointment I can find is that of Dr. **Paddy**, who was appointed reader of the anatomy lectures on the 11th July, 1596.

The study of anatomy does not seem to have been so little thought of at this time as generally believed, in proof of which it may be mentioned that Sir **Edward Arris**, an alderman of London, who was also warden in 1642, and master of the Company of Barbers and Surgeons in 1651, founded on the 27th October, 1645, six anatomical lectures, to be publicly read every year between Michaelmas and Christmas, and endowed them with 300*l.*, on condition that the Company should pay for the lectures 20*l.* a-year: subsequently he exchanged this sum for an annuity of 30*l.* charged on his estates, and at a later period redeemed this charge by paying 510*l.* to the Company, which was by them paid over at the dissolution to the Surgeons' Company, and, when the latter merged into the College of Surgeons, the same was handed over to them. **Arris**'s good example was followed by Mr. **John Gale**, who, on the 30th June, 1698, founded one anatomy lecture every year, to be called **Gale**'s Anatomy, and endowed it with a rent-charge of 16*l.* a-year out of certain landed property, which was subsequently sold for 432*l.* sterling, and the interest thereon now produces rather more than 20*l.* The two endowments are now consolidated, and the lectures on human anatomy and Surgery are called Arris's and Gale's Lectures.—J. F. S.]

In this way, assisted by the advance of anatomy, was Surgery raised, by Paré, Franco, Fabricius Hildanus, Fabricius ab Aquapendente, Severinus, and Wiesemann, in the sixteenth century, to a high station.

In the second half of the sixteenth century actually commences the brilliant period of Surgery. Numerous wars and the establishment of public hospitals presented a rich field for observation, and the foundation of the Academy of Surgery at Paris collected scattered powers and aroused a general emulation. In France shone out Dionis, J. L. Petit, Mareschal, Quesnay, Morand (*a*), Louis, Ledran, Garengeot, Lafaye, Lecat, Lamotte, Ravaton, David, Pouteau, Levret, Sabatier, Desault; in England, Wiseman, Cheselden (*b*), Douglas, the two Monros, Sharp, Cowper, Alanson, Pott, Hawkins, Smellie, and the two Hunters; in Holland, Albin, Deventer, Camper; in Italy, Mollinelli, Bertrandi, Moscati, Scarpa; in Germany, Heister, Plattner, Bilguer, Brambilla, Theden, Richter, C. Siebold, and Mursinna.

By this general cultivation has Surgery been brought up in modern times to an elevation which cannot be displayed generally but only in the history of the several operations. Boldness grounded on the progress of anatomy and physiology, simplicity in the methods of treatment, and scientific culture, distinguish it.

The equal participation of all civilized nations in these efforts keeps up amongst them a contest for intellectual superiority in the ranks of improvement, while it makes any decisive award impossible.

(*a*) He was Secretary to the Academy of Surgery, and, on the opening of the schools in 1743, delivered a most admirable address, "Discours dans lequel on prouve qu'il est nécessaire au Chirurgien d'être lettré," in which he shows the necessity of a literary education for a Surgeon, and mentions incidentally that the royal declaration founding the Academy, required "that the Surgeons of Paris should be Masters of Arts before admission into the community, and that they should then pursue Surgery without mixing any mechanics," "loi précieuse," says he, "qui, faisant une des époques les plus mémorables pour l'illustration de notre art, doit immortaliser celui (De la Peyronie) qui la sollicitée et dont les titres éminens sont soutenus par un mérite supérieur." *Opuscules de Chirurgie*, p. 118. Paris, 1768. 4to.

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FIRST DIVISION.

OF INFLAMMATION.

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1. INFLAMMATION (*Inflammatio, Phlogosis,* Lat.; *Entzündung,* Germ.; *Inflammation,* Fr.) is that condition of an organized part in which the vital process and plasticity of the blood are unnaturally raised, and which is manifested by pain, redness, increased temperature, and swelling.

The elevation of the vital process must be of a certain duration and intensity, that is it must be actually diseased, when we apply to it the name *Inflammation.* Thereby, alone is inflammation distinguished from [the temporary condition of *active congestion* and increased *turgor vitalis.* The proximate cause of these phenomena is indeed the same as in inflammation, and may run into it. The same applies to the so-called inflammatory irritation.

[The term "inflammation" has been objected to by ANDRAL (*a*), one of the most able French writers on pathology. He says:—"Created in the infancy of science, this expression, (inflammation,) completely metaphorical, was destined to represent a morbid condition, in which parts seemed to burn, to inflame, as if they had been subjected to the action of fire. Received into the language, without any precise idea having ever been attached to it, under the triple relation of symptoms which announce it, of lesions which characterize it, and of its actual nature, the expression "inflammation" has become so vague, and its interpretation so arbitrary, that it has really lost all value: it is like a piece of old money without the impress, which must be put out of circulation, as it causes only error and confusion. Inflammation can only be considered as the expression of a complex phenomenon, comprehending many other phenomena, the dependence of which is neither necessary nor constant." (vol. i. p. 9.) He has, therefore, chosen to set aside the term "inflammation" as generally characterizing the phenomena we are about to consider, and has employed that of "hyperæmy," restricting it, however, only to that condition of the vessels in which they are loaded or congested with blood, from whatever cause, healthy or unhealthy, such condition may arise. JOHN HUNTER (*b*) seems to have anticipated these objections; for, he observes:—"The term or idea of inflammation may be too general, yet it is probable that it may form a genus, in which there is a number of species, or it may be more confined in its classification, and be reckoned a species containing several varieties. These are, however, so connected among themselves, that we cannot justly understand any one of the species or varieties without forming some idea of the whole, by which means, when treating of any one, we can better contrast it with the others, which gives us a clearer idea, both of the one we are treating of, and of the whole." (p. 265.) The difficulty, however, is to distinguish the onset of the diseased action, inflammation, from the natural one, congestion or turgescence. Their close resemblance was first pointed out by HUNTER, who observes:—"The very first act of the vessels when the stimulus which excites inflammation is applied, is, I believe, exactly similar to a blush. It is, I believe, simply an increase or distension beyond their natural (ordinary?) size. This effect we see takes place on many occasions: gentle friction on the skin produces it; gently stimulating medicines have the same effect; a warm glow is the consequence similar to that of the cheek in a blush: and, if either of these be increased or continued, real inflammation will be the consequence." (p. 279.) So ANDRAL:—"Will anatomy establish any line of demarcation between physiological (healthy) and pathological congestion? No more than the latter can always be strictly separated from the complex phenomenon called "inflammation." Thus, under the influence of violent emotion, vessels appear on the conjunctive coat of the eye, and the lids become red. The same effect follows a grain of sand falling on the front of the eye; insensibly does the congestion increase from that almost normal condition in which vessels appear on the conjunctive coat to that when the mucous membrane of the eye, becoming uniformly red and considerably swelled, presents that variety of opthalmy known as *chemosis.*" (vol. i. p. 13.) The same language is held by MULLER (*c*):—"Inflammation begins, indeed, with phenomena which are similar to turgescence. The organs attract more blood than usual, in consequence of the altered affinity between the blood and the tissue, and obstructs its efflux; but we must be very cautious in calling increased vital action that important change caused by inflammatory irritation which produces functional disturbance, and has consequent to it an effort of nature to compensate an injury which has interfered with the action of the organ. Had the vital action been increased, so would not the morbid processes of inflammation have occurred." (vol. i. p. 218.) HUNTER also observes:—"Though pure inflammation is rather an effort of nature than a disease, yet it always implies disease or disturbance, inas-

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(*a*) Précis d'Anatomie Pathologique. (*b*) On the Blood, Inflammation, &c.
(*c*) Handbuch der Physiologie des Menschen.

much as there must be a previous morbid or disturbed state to make such effort necessary." (p. 260.) Again:—" Inflammation is to be considered only as a disturbed state of parts which require a new but salutary mode of action to restore them to that state wherein a natural mode of action alone is necessary: from such a view of the subject, therefore, inflammation in itself is not to be considered as a disease, but as a salutary operation, consequent either to some violence or some disease." (p. 249.) " Inflammation is not only occasionally the cause of diseases, but it is often a mode of cure, since it frequently produces a resolution of indurated parts, by changing the diseased action into a salutary one, if capable of resolution." (p. 250.) " Inflammation may first be divided into two kinds as first principles, viz., the healthy and the unhealthy. The healthy probably consists only of one kind, not being divisible but into its different stages, and is that which will always attend a healthy constitution or part, is rather to be considered as a restorative action than a diseased one, and would rather appear to be an effect of a stimulus than an irritation. The unhealthy admits of vast variety, (diseases being almost numberless,) and is that which always attends an unhealthy constitution or part, but principally according to the constitution: however, many parts naturally have a tendency to run into inflammations of particular kinds.* * The simple act of inflammation cannot be called specific, for it is an uniform or simple action in itself; but it may have peculiarities or specific actions superadded. Inflammation is either single or compound: it may be called single when it has only one mode of action in the part inflamed, as in its first stages; compound, when attended with another mode of action, or when it produces other effects." (p. 251.)]

2. All organs of the body may become inflamed except the cuticle, hair, and nails. The disposition to become inflamed depends on the number of nerves and capillary vessels in a part. The actual seat of inflammation is always the capillary-vascular system, and the ganglionic-nervous system, accompanying the most delicate branches of the vessels, which specially presides over vegetation in the organism.

[" Inflammation," says Hunter, " may arise from very different causes, and often without any apparent cause, and its operations are far more extensive than simply the act of producing union in parts divided by violence." (p. 248.) " Susceptibility for inflammation may be said to have two causes—the one original, the other acquired. The original constitutes a part of the animal economy, and is probably inexplicable. Of the acquired, it is probable that climate and modes of life may tend considerably either to diminish or increase the susceptibility for inflammation. The influence, however, of climate may not be so great as it commonly appears to be; for it is generally accompanied by modes of life that are not suited to others." (p. 226.) " Inflammation, when the constitution is strong, will be commonly the most manageable, for strength lessens irritability; but in every kind of constitution inflammation will be the most manageable where the power and the action are pretty well proportioned; but, as every part of the body has not equal strength, these proportions cannot be the same in every part of the same constitution. According to this idea of strength, the following parts—viz., muscles, cellular membrane, and skin,—and more so, in proportion as they are nearer to the source of the circulation—will be most manageable in inflammation and its consequences, because they are stronger in their powers of action than the other parts of the body. The other parts, as bone, tendon, ligament, &c., fall into an inflammation, which is less in the power of art to manage, because, though the constitution is good, yet they have less powers within themselves, and therefore are attended with the feeling of their own weakness; and I believe they affect the constitution more readily than the former, because the constitution is more affected by local disease, when the parts have less power within themselves of doing well; and the effects, if bad on the constitution, reflect a backwardness on the little powers they have. * * * The inflammation, if in vital parts, will be still less manageable; for, although the parts themselves may have pretty strong powers, yet the constitution and the natural operations of universal health become so much affected, that no salutary effect can so readily take place, and therefore the disease becomes less manageable. * * * In weak constitutions, although the inflammation be in parts which admit of the most salutary operations, in the time of the disease, and in situations the most favourable to restoration after disease, yet the operations of inflammation are proportionably more backward as to their salutary effects in such constitutions, and more or less, according to the nature of the parts affected." (pp. 228, 9.)]

3. Inflammation always commences with a more or less intense pain; the sensibility of the part is increased, redness soon follows, and blood appears in vessels where previously it had not been observed; the temperature of the part is raised, its functions disturbed, secretion suppressed, (at least at first,) or changed, perspiration diminished, and the part swelled. These appearances are developed, in different proportions, to a higher degree, in which fever (*Febris inflammatoria secunda*) usually becomes connected with them.

[I apprehend it would be more correct to say that "inflammation, from its very commencement, is always accompanied with a more or less intense pain," than to say, with our author, it "always commences with a more or less intense pain;" inasmuch as, though that by which the patient's attention is first excited, yet it is only an indication of a disturbance set up in the economy, and which, as it becomes greater, renders itself apparent to the eye, most commonly by redness.—J. F. S.

Dr. ALISON (*a*) observes:—"In order to give the requisite precision to the general notion of inflammation as a local change of the condition of any part of the body, it seems only necessary to include in it, besides the pain, swelling, heat, and redness, the tendency always observed, even when the changes in question are of short duration, to effusion from the blood-vessels of some new products; speedily assuming in most instances the form either of coagulable lymph or of purulent matter." (vol. i. p. 53.)]

4. The pain depends on the increased activity of the nerves (1), and this again produces the succeeding increased influx of the blood, and the vital expansion of the vessels (2); afterwards the pain is increased by the decided expansion and tension which the part suffers. It differs according to the degree of inflammation and the sensibility of the affected part: often it consists only in the sensation of prickling, itching, tickling, and a troublesome stretching; often is it stabbing, tearing, burning, and, in structures largely supplied with nerves, it attains a most vehement degree (3).

The redness, heat, and swelling, depend on the increased action of the nerves and capillary vessels, and is in immediate relation with the richness of their ramifications. Hence the various degrees of redness, heat, and swelling, according to the degree of inflammation and the organs therewith affected. At the onset of the inflammation the swelling always depends on an increase of blood. The reddening of the blood (4) and evolution of warmth are attributes of the living process: they must, therefore, be also increased by its greater activity. According, however, to experiments with the thermometer, the warmth in inflamed parts is not so considerable as to our touch it seems to be (5). Where the most delicate branches of the capillary-vascular system anastomose to form the transition into the veins, several capillary vessels always open together into one single vein. By this disposition of the capillary-vascular system there is already in the healthy state a slower motion of the blood, which is in close relation to the functions of the capillary-vascular system. If, then, in inflammation there be an additional influx of blood, there must arise with the *increased activity* of the capillary-vascular system and vital expansion (6) an accumulation of it, (the blood,) as the veins are not in a condition to take up and carry away with equal readiness the blood which is brought to them in excess. The capillary vessels become therefore expanded, as if filled by artificial injection, and even distinct in those parts where we assume that in the natural state vessels carrying only the uncoloured part of the blood exist: in the subsequent course of the inflammation new vascular branches are formed. The cellular tissue is the most especial seat of the development of vessels. These occurrences are the cause why

(*a*) Library of Medicine.

the inflammation, which at first was to be considered merely as a dynamic disease, brings about distinct changes in the structure of organs. The increased activity of the nerves and capillary-vascular system produces a more copious infiltration into the cellular tissue than in the natural state; a part of the serum—in some cases even of the red part of the blood—penetrates through the expanded walls of the vessels, and empties itself into the cellular tissue. The walls of the cells are, therefore, in this case, found thickened, filled with a serous, albuminous, often bloody fluid, in which frequently albuminous flakes float or are connected with the walls of the cells. The changed condition and increased plasticity of the blood is shown by the *crusta inflammatoria*, which consists of the fibrin of the blood.

According to the different degree of irritation, and the consequent reaction of the nervous system, so long as, excepting the pain, no other appearance of inflammation exists, (which condition many consider as the forerunner of inflammation,) there is produced a spasmodic contraction with accelerated motion of the blood in the small vessels, upon which first follow their vital expansion, the greater influx of blood, and the other phenomena of increased living actions (7). A comparison may therefore be instituted between these local appearances and those coming in with inflammatory fever. As we have there contractions of the vessels and obstruction of the circulation, so we have here chilliness, contraction of the skin, small pulse, which are followed by the phenomena of vital expansion of the vascular system, increased warmth, and so on. In the commencement there is in a manner present an inflammatory spasm—the vascular system is entirely controlled by the nervous system. With the increased influx of the blood, and its accumulation in the capillary vessels, is the previously quickened motion of the blood corpuscles retarded, the capillary vessels, by the consequent exudation of the serum, become completely filled with blood-corpuscles, and an actual stagnation, an inflammatory stasis ensues, but which is not to be considered as a passive over-filling.

[(1) But what causes this increased action of the nerves? The squeezing and stretching of the minute nerves of the part, by the increased size of the capillary vessels, resulting from the obstruction of the current of blood through them, which occurs at the very onset, and which, indeed, is, as will be presently shown, the first step of the inflammatory process. Travers (*a*) considers "the pain of inflammation directly or indirectly connected with the state of the blood-vessels," and it is, "probably, the nerves of the blood-vessels that are first excited in the pain of inflammation." (pp. 46, 7.) This opinion is corroborated by referring to John Hunter's observations on the passage of the adhesive to the suppurative inflammation, in which he says, "The pain is increased at the time of the dilating of the arteries, which gives the sensation called throbbing, in which every one can count his own pulse, from paying attention merely to the inflamed part; and perhaps this last symptom is one of the best characteristics of this species of inflammation." (p. 378.) And in a previous passage he had observed:—"Whether this pain arises from the distension of the artery by the force of the heart, or whether it arises from the action of distension from the force of the artery itself, is not easily determined." (p. 287.) The throbbing, however, is not entirely confined to suppurative, but also accompanies acute, inflammation; and Travers has well observed:—"Throbbing, lancinating or pulsatile pain,—*i. e.* pain accompanied with a sense of motion of the fluids in the part,—is the most characteristic distinction of acute inflammation; and an obtuse, aching, or heavy pain belongs to a congested state of the local circulation." And he also points out that "the description of pain unattended with inflammation, differs from the pain of inflammation, although the former is subject also to varieties in kind, duration and intensity;" observing that "Neuralgia is generally attended more or less with muscular cramp or spasm, and such pain is either intermitting or periodical;" and that such medicaments "as relieve pain in the absence of inflammation have little or no beneficial effect on the pain of inflammation. Blood-letting aggravates neuralgia and relieves inflammatory pain. Steel and arsenic aggravate inflammatory pain, and cure neuralgia." (pp. 45, 6.)

(2) According to his neuropathological theory, Henle (*b*) asserts, that "it is through the nervous system that the exciting cause of inflammation operates, by suspending the

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(*a*) Physiology of Inflammation.

(*b*) I have made use of the Digest of this Author's Pathologische Untersuchungen, 1840, and of his Bericht über die Arbeiten im Gebiet der rationellen Pathologie seit Anfang des Jahres, 1839; in Wharton Jones's excellent Report on the Theory of Inflammation, in Forbes's Brit. and For. Med. Review, vol. xvii., 1844.—(J. F. S.)

nervous influence from the small vessels, and consequently determining relaxation of their walls with dilatation of their calibre." (p. 578.) The mode of action of the exciting cause he describes as follows:—"The exciting cause, of what nature soever it may be, whether external or internal, acts primarily on sensitive nerves, exalting their activity. The motor nerves of the vessels which have sympathetical relations with the excited sensitive nerves, are secondarily affected. But this affection of the motor nerves of the vessels, which supervenes by reflex action on the excitement of the sensitive nerves, is not a corresponding state of excitement, but an opposite one of depression, of suspension of action, of paralysis. This form of sympathy, on which the state of excitement of one nerve determines depression of another, **Henle** calls *antagonism;* when to that in which a state of activity of one nerve is called forth by a corresponding state of another, he applies the term *sympathy* in a more restricted sense than generally employed: the latter form is more common in the domain of the cerebrospinal system; the former in that of the ganglionic system, the source of the nerves of the vessels. Sometimes, however, sympathy is exemplified in the vessels by constriction supervening on irritation and preceding dilatation; but, in most cases, relaxation and dilatation of the vessels from suspension of nervous influence, are the primary effect of the irritation, no matter whether that irritation have been violent or moderate. Hence **Henle** contends that the relaxation of the vessels, on which their dilatation depends, cannot be a mere consequence of exhaustion of the vessels from previous action, as suggested by **Alison** and **Billing**, but can only be antagonistic." (p. 582.)

As to the cause of inflammation, **Hunter** observes:—"I will venture to say, that any cause which can obstruct the motion of the blood for a given time, will become the cause of inflammation; for, either the cause of the obstruction itself, or the blood being retained in the smaller vessels for a certain time, will either irritate or unite the parts, or, where it irritates, will throw the vessels into such actions as naturally arise out of an extraneous irritating cause, but not an increased motion of the blood behind, to drive on the obstructed blood through these vessels, as has been supposed." (p. 259.) The truth of these views is fully borne out by the observations of more recent inquiries, some of which will be presently detailed.

(3) In reference to the pain in inflammation, **Hunter** also notices that, as "Many parts of the body in a natural state give peculiar sensations when impressed: so when they are injured they give likewise pain peculiar to themselves;" of which the pain caused by squeezing or inflammation of the testicle is a good example. "And I may also observe," he says, "that the same mode of impression shall give a peculiar sensation to one part, while it shall give pain to another: thus, what will produce sickness in the stomach, will produce pain in the colon." (pp. 288, 9.)

Travers makes a remark shewing that pain is not necessarily an attendant on inflammation, which is well worth remembrance, and with which few careful observers will not accord. "We are told," says he, "there can be no inflammation where there is no pain. I reply, that there are many, and destructive too; a joint, an eye, nay, the lungs may be destroyed by inflammation without pain; he is a speculative, not a practical, pathologist who does not know this. It would be easy to superinduce pain in either of these cases; but let there be no interference, and the work of destruction in numberless cases is as silent as it is sure." (p. 29.)

(4) Touching the redness, **Hunter** observes:—"It is of various hues, according to the nature of the inflammation: if healthy, it is a pale red; if less healthy, the colour will be darker, more of a purple, and so on, till it shall be a bluish purple; * * * it is gradually lost in the surrounding part if the inflammation is of the healthy kind; but, in many others it has a determined edge, as in the true erysipelatous, and in some specific diseases, as in the small-pox." * * * "This increase of red appears to arise from two causes: the first is a dilatation of the vessels, whereby a greater quantity of blood is allowed to pass into those vessels which only admitted serum or lymph before; the second is owing probably to new vessels being set up in the extravasated uniting coagluating lymph." (pp. 283, 4.)

Travers thinks that the intensity of the redness depends "on the degree of fulness (of the vessels) compatible with motion; for, although the oxygen of the atmosphere will redden the blood in the congested vessels of the surface, while circulation, however imperfect, continues, from the commencement of the state of absolute stagnation, the colour gradually undergoes a change from pink to purple. In some modes of inflammation this shade of colour prevails even from the beginning, and soon turns to livid. * * * These varieties are due to the state of the general circulation, which gives its character to the inflammation, and an attending change in the constitution of the blood." (p. 50.)

(5) John Hunter observes on this point:—"From all the observations and experiments I have made, I do not find that a local inflammation can increase the local heat above the natural heat of the animal." The experiments he made were, 1. in the inflamed cavities of hydroceles, in which the thermometer stood at 98¾° F., an increase ended of 6¾° on the natural heat ascertained prior to the inflammation; but, as Hunter states, "not equal to that of the blood probably at the source of circulation in the same man:" 2. in a wound of a dog's chest, in which before and after inflammation the heat was 101°: 3. in a wound in the gluteal muscles of an ass 100° before, and varying from 99° to 101½° after inflammation: 4. in the vagina of an ass from 99½°, as before the inflammation to 100½°. In other experiments on mucous surfaces the heat was sometimes the same as before the inflammation, and sometimes increased 1° or 2°." (p. 293 to 300.) "But," as says Travers, "the nerves measure the sensation rather than the degree of heat, and this is a widely different scale from those of Fahrenheit or Réaumur, * * * this determination of blood to the capillaries in blushing is accompanied with a distinct though transient sensation of burning heat to the individual, yet not such as could be ascertained by the most delicate thermometer. It is most probably to be referred to the extraordinary inlet of arterial blood into the capillaries: its longer detention by the congestion proper to inflammation, and the consequent increase and vigour of the neighbouring circulation would give permanency to the sensation, and render the actual increase of temperature appreciable." (pp. 48, 9.)

(6) In reference to the enlargement of the vessels of an inflamed part, and its visibly-increased vascularity, Hunter observes, that, "instead of an *increased attraction*, there was rather what would appear an *increased relaxation*, of their muscular powers, being, as we might suppose, left to the elasticity entirely. This would be reducing them to a state of paralysis simply: but the power of muscular contraction would seem to give way to inflammation; for they certainly dilate more in inflammation than the elastic power would allow: and it must also be supposed that the elastic power of the artery must be dilated in the same proportion." And he comes to the conclusion, "When we consider the whole of this as a necessary operation of nature, we must suppose it something more than, *simply, a common relaxation*: we must suppose it an action in the parts *to produce increase of size*, to answer particular purposes; and this I should call the *action of dilatation*." (p. 282.)

(7) This is pretty nearly the opinion of Dr. Cullen, who taught that spasm of the extreme arteries supporting an increased action in the course of them, may be considered as the proximate cause of inflammation, at least in all cases not arising from direct stimuli applied; and, even in this case, the stimuli may be supposed to produce a spasm of the extreme vessels.

The following is a brief account of Dr. John Thomson's (*a*) observations on the variation of the current of the blood through the capillaries, resulting from the application of different substances:—"Weak and strong spirits of wine were applied to the smallest arteries of the web in eight or nine different frogs, but without being able to perceive any sensible change in the diameters of the arteries to which the spirits were immediately applied, though the general circulation through the web seemed to be increased by each application of the spirits. The results were the same when the tincture of opium was employed." Weak volatile alkali, or ammonia, produced "a complete contraction in the arteries to which it was more immediately applied. In upwards of one hundred experiments the contraction produced took place in *less than two* minutes after the application of the ammonia. In thirteen experiments contraction did not take place till after a period of *three* minutes. In three or four instances only, in which the ammonia was applied, were the contractions not induced." (p. 83.) "In some instances I thought I could perceive an *increase* of the velocity of the general circulation immediately after the application of the ammonia; in others, this increase, if it took place, *was so small as to be imperceptible:* but the first and most remarkable visible effect of the contraction of the artery from the application of ammonia was a *diminution of the velocity* of the circulation in the capillary vessels with which the contracting artery communicates. When the contraction is complete, a *temporary* stagnation in the capillaries with which the contracted artery immediately communicates is *often* produced. * * * In all these experiments, in which ammonia alone was applied, a paleness rather than redness of the web in the foot of the frog was produced; but this paleness was only of short duration." (p. 84.) "In applying a saturated solution of common salt to the arteries in the web of the frog's foot, I was not a little surprised to observe that these arteries, instead of being contracted as they had uniformly been by the application of the ammonia, were actually and sensibly

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(*a*) Lectures on Inflammation.

dilated. The part of the web to which the salt was applied became of a red colour, and this redness, which was visible to the naked eye, lasted in general from a period of three to five or more minutes. It was impossible to view the part with the naked eye, without conceiving it *to be inflamed*." **Thomson** hoped, from "the facility of producing, by the application of salt, a state so accurately resembling inflammation that, by examining the phenomena of the circulation in this state, he should be able to arrive at some satisfactory conclusions with respect to the comparative velocity of the blood in healthy and in inflamed vessels; but he did not upon trial find this so very easy as he had at first imagined. (p. 85.) "The principal difficulty in ascertaining the comparative velocity of the blood in the sound and in the red or apparently inflamed parts arose from the very *variable* results which the application of salt produced in different animals, and in the same animal, in different circumstances." Thus, in nine cases, "the application of the salt was not only followed by a bright red colour visible to the naked eye, and a sensible enlargement of the arterial and venous branches, but with an increased rapidity of circulation also in the capillary vessels. * * * The repeated application, however, of the salt to the same vessels was *always sooner or later* followed by *retarded* capillary circulation, or even by *complete stagnation*. A second general result from the application of the salt was an apparent increase of circulation in the arteries and veins, with a diminution of velocity in the capillary branches. * * * In no one experiment have I been able to perceive any enlargement of an artery during the momentary influx of blood into its canal. The third and *most frequent* result from the application of salt was *diminished* rapidity of circulation in arteries, veins, and capillaries. In seventeen experiments the circulation became *so slow* as to stop altogether in the capillaries, and this stagnation, which usually goes off in a few minutes, continued in some instances for several hours. The enlargement of diameter in arteries, veins, and capillaries is very conspicuous: they may be said to be distended. * * * In every experiment with salt, whether the velocity of the circulation was increased, diminished, or stopped, the diameters of the blood vessels were *uniformly enlarged*, and this increase of diameter continued till the redness spontaneously disappeared." (pp. 86, 7.) From these observations **Thomson** comes to the conclusion, that, "If this view of the state of the circulation in inflamed vessels be just, it will follow that inflammation is sometimes attended by an increased, and at others by a diminished velocity in the circulation through the capillary vessels of the inflamed part, and, consequently, that neither of those two states ought to be included in the definition which we give of inflammation." (p. 88.) These experiments and conclusion of Dr. **Thomson** are mentioned, because they are the first by which the condition of the vessels and the state of the circulation under inflammation have been attempted to be explained: but they are inconclusive; for, as observed by J. W. **Earle** (*a*), "although that state of parts which was induced by the application of salt, viz. retardation and stagnation of the blood, presented the strongest resemblance to inflammation, yet in no one instance did either state continue for a sufficient length of time to allow any one of the usual accompaniments of inflammation (to wit, the effusion of lymph or pus, or mortification) to be produced, since each variation terminated more or less speedily in the restoration of the natural current." (p. 40.)

Dr. W. **Philip** (*b*) applied "to the web of a frog's foot, placed under a microscope, distilled spirits, and in a few seconds observed the blood in all the vessels moved with a greatly *increased* velocity, which, as he constantly kept the web wet with the distilled spirits, continued as long as he observed it, ten minutes or a quarter of an hour; but during no part of the time could he perceive the *slightest symptom* of inflammation, either with or without the microscope. The vessels, instead of appearing redder and more turgid, were evidently paler and smaller than before the application of the spirits." (p. 30.) Hence it appears that his experiment does not in its result tally with **Thomson's**, who at first did not observe any increased velocity, nor ever any sensible change in the diameter of the arteries. It is probable that in neither case did the spirit operate beyond constricting the parts by the cold its evaporation produced. In another experiment, however, inflammation was produced in the web of a frog's foot, and then Dr. W. **Philip** (*c*) "found the vessels of the part greatly dilated and the motion of the blood extremely languid. In several places where the inflammation was greatest, the vessels were most distended and the motions of the blood were slowest." (p. 15.) He therefore considered that in inflammation the blood vessels were in a state of debility.

(*a*) On the Nature of Inflammation, &c.

(*b*) An Experimental Inquiry into the Laws of the Vital Functions. London, 1826. 8vo.

(*c*) Introduction to a Treatise on Symptomatic Fevers, including Inflammations, &c. 4th Edit. London, 1820.

The account given by **Gendrin** (*a*) of the steps by which the stagnation of the blood in inflammation is produced is very interesting:—"The capillaries around this (irritated) point dilate, and seem to multiply themselves; because a greater number is perceived on account of the presence of red blood, which, in colouring them, renders them more visible. The globules arrive; they are crowded together, their motion is retarded, and at length suspended; they *revolve upon themselves*, and at last remain entirely at rest. The capillary circulation is then evidently suspended in the point irritated; for some distance around, the retardation of the circulation and dilatation of the capillaries are plainly seen; a little farther off the circulation is more rapid, the capillaries being still dilated, and the globules of the blood less distinct; finally, at the limits of the inflamed areola the circulation is, on the contrary, accelerated, the capillaries dilated, and the blood contains a greater number of globules. All these changes may take place in four or five minutes, and the same space of time is sufficient to allow of the capillary circulation returning to its natural state." (vol. ii. p. 475.) The objection made by **Earle** to **Thomson's** experiment, that inflammation had not been excited, might perhaps, strictly speaking, be made use of here; but it is quite clear that the experiment had reached the turning point from healthy to diseased action.

Thomson's experiments have been repeated and detailed by **Travers**, in his chapter, *Direct Effects of Stimuli and of Wound*, and all coincide in producing the same phenomena, excepting that with ammonia; in which **Travers's** observations are remarkably opposed to those of **Thomson**; for "the application of ammonia," says he, "produced an *instant increase of velocity*, then stagnation, with the deepened tint of colour and enlargement of vessels." (p. 36).

Travers gives a very beautiful account of "the oscillation attending the recovery of the circulation, which seems to be the *punctum saliens*, or first movement towards the formation of the new circulation." (p. 166.) * * * "The first effect of a drop of stimulant fluid, or of a wound upon a transparent web, (frog's foot,) as seen in the field of a powerful microscope, is," says he, "to arrest the circulation at the part. Around the point of absolute stagnation, the column of blood oscillates, and the particles are seen to separate and congregate in small irregular masses, presenting varieties of shape, some being perfect ellipses, others spherical. The vessels are dilated, and, in proportion, their fulness is increased, and their pink colour heightened. Still more remote from the stagnant centre increased activity of circulation prevails. The point of stagnation, the very slow circulation in the part immediately surrounding it, the current still oscillating in parts, and beyond this the more rapid and vigorous circulation, are manifested for several days. The contrasted appearance of one portion of the web stationary, and another in brisk circulation, is striking. The labour also of the current, the sudden overcoming of the obstacle occasioned by a too crowded passage, and the instant velocity succeeding thereupon, reminds us of the swaying backward and forward, and at length the inrush, of a crowd emerging into an open space from a narrow avenue." (p. 34, 35.)

Bennett says:—"It is very difficult to determine the cause of oscillation in the column of blood. It may be remarked, however, that this phenomenon has only been observed in the smaller animals which are held fast under the microscope. Even here the oscillation is not invariably seen to precede the stoppage. It is most frequently observed, also, when the animal is very weak, or has fallen into asphyxia. Under such circumstances the energy of the heart and large vessels is evidently diminished, and the blood will be propelled with less force than usual against the capillaries, and either stop for a moment, or flow backwards during the diastole of the heart. It is probable, therefore, that the oscillation does not essentially belong to inflammation, but rather depends upon the general weakness of the animal." (p. 33.)

The phenomena attending the first steps of the inflammatory process excited in the web of a frog's foot, as seen under the microscope, are well described by **Wharton Jones** (*b*). "Very soon after the irritation," he says, "accumulation and stagnation of the blood in the capillaries, including the terminations of the arteries and radicles of the veins of the part, is observed to take place; but, amidst the obstructed vessels a few here and there may still be seen pervious, and through them the stream of blood is very rapid. The accumulation and stagnation of the blood in the small vessels is always preceded by a retardation of its flow (coincident with dilatation of the vessels;) this retardation of the flow of blood having or not been preceded by the opposite condition of an accelerated flow (coincident with constriction of the vessels.)" He then proceeds to inquire into "the behaviour of the blood during the retardation of its flow and at

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(*a*) Hist. Anat. des Inflammations.

(*b*) Report.

the time of its stagnation," which he thus describes:—"a. *Colourless corpuscles.* During the retarded flow of blood immediately preceding stagnation, an accumulation of colourless corpuscles is observed to take place on the inner surface of the walls of the dilated small vessels, similar to what occurs in the healthy state when the velocity of the stream of blood is diminished. b. *Red corpuscles.* While the accumulated colourless corpuscles may have even become stagnant on the walls of the vessels, the red corpuscles, though in increased quantity, in proportion to the plasma, still continued to float on, but more and more slowly until complete stagnation ensues. They are somewhat more collapsed than natural; hence they appear redder, and their nucleus is less indistinctly seen, a change similar to what takes place in the red corpuscles of newly drawn blood. The red corpuscles appeared to be the agents principally concerned in the stagnation of the blood * * * by agglomerating together, and applying themselves here and there flat against the walls of the vessels and adhering to them; whilst other red corpuscles applied themselves to those already adherent." (p. 568, 9.) This view had been already put forward by JONES in 1842; and about the same time was described more at length by EMMERT and by VOGEL. The following is the brief account which JONES gives of their statement. According to EMMERT, the colour of the red globules becomes somewhat deeper, and hence individually they appear less transparent; their surface is less smooth, and the irregularity of their edges is peculiarly distinct: they acquire the property of remaining adherent to each other and to the walls of the vessels when they come in contact with them. When the flow of blood becomes retarded and oscillations commence, the blood-corpuscles apply themselves, according to VOGEL, more to each other; and, though still individually distinguishable, they still touch, and in the smaller capillaries are often pressed close together by their surfaces in the manner of rolls of coin. The space next the walls seems merely filled with plasma; but, in complete stagnation of the blood, it disappears, and the interior of the vessel is completely filled with blood-corpuscles closely aggregated, and forming an apparently homogeneous indistinctly granular mass, in which individual blood corpuscles can scarcely be distinguished: but this fusion is merely apparent; for, if the blood be evacuated by opening the vessels, the individual corpuscles again appear quite distinct." (p. 568.)—J. F. S.]

5. Every injury which acts as an irritant upon any one organic part, may be considered as an incidental cause of inflammation. The necessary intensity of this irritation cannot, in general, be determined; it depends upon the individual susceptibility and condition of the organs. Powerful, young, full-blooded, sanguine, or choleric subjects, are most prone to inflammation; the disposition to which is strongest when the fibrin of the blood is increased in quantity. Inflammation arises most readily in parts which are very sensitive, and in which the capillary-vascular system is much developed. The usual incidental causes of inflammation are, a peculiar condition of our juices differing from the natural commixture, suppression of ordinary discharges, contagious matter, mechanical influences, falls, blows, wounds, and so on, cooling after preceding heat, burning by fire, corroding substances, and so on.

[To these we may also add, with JOHN HUNTER, "that fever is often the cause of local inflammation. We see this happen every day. * * * These inflammations, in consequence of fever, are commonly supposed to be critical; but I very much doubt the truth of this opinion." (p. 257.)

"Irritating substances," says JOHN HUNTER, "when of no specific kind, produce inflammation sooner than other visible causes of inflammation. If of a specific kind, then the time, sort, and violence will be according to that kind. But irritating applications must be continued for some time to produce violent inflammation. These differences are easily accounted for: quick death does not irritate the part killed, and the contiguous living part, not being itself hurt, is only irritated to get rid of the dead part. A wound is a quick irritation of a living part, so that it inflames more readily and more violently, according to the quantity of irritation; but that cannot be of long standing, as nature sets about procuring relief. But when irritating substances are applied, the part inflames quickly, according to their power of irritation; and, if they are continued, nature is not allowed to relieve herself, but is constantly teased, by which means the inflammation becomes also violent." (p. 257.) "All inflammations attended with disease have some specific quality which simple inflammation has not; and in such cases it is the specific quality which is the disease, and not the inflammation." (p. 260.) "There are many constitutions which have a tendency to specific diseases, that, when injured by fever or any constitutional complaint, readily produce the specific inflammation in such parts of the body as have the greatest susceptibility for any specific action; or, if such parts are affected by any local violence, the parts affected will not go through the healthy adhesive inflammation, nor will they enter into the healthy suppurative inflammation, but will fall into the specific inflammation peculiar to the habit: such is the case with an erysipelatous habit. Or, if a specific inflammation has already taken place, any violence done to it, when already begun, will increase that disposition and action, which we plainly see to be the case with the scrofula, because this disease can, and often does, arise from such a cause alone." (p. 261.)]

6. The *results* of inflammation are *resolution*, *exudation*, *suppuration*, *ulceration*, *induration*, *and various other transformations of organs*, *softening*, and *mortification*. All these conditions, excepting resolution, are merely different living processes, which are brought about by inflammation, and are still accompanied by it for a long time.

7. In Resolution (*Resolutio*, Lat.; *Zertheilung*, Germ.; *Résolution*, Fr.) the appearances of inflammation subside nearly in the same order as in their development they set in with, and the diseased part reverts to its natural condition. The pain diminishes, or disappears first; in the same degree the temperature and the redness lessen, the swelling alone often remains for a still longer time, till the absorption of the serous or albuminous fluid poured into the cellular tissue is completed.

We may hope for this result when the inflammation has not quickly run on to a great extent, the pain neither particularly severe nor throbbing; and when the fever accompanying the inflammation terminates critically in perspiration and deposit in the urine.

Resolution is distinguished from the *disappearance* or *recession* (*Verschwinden* oder *Zurücktreten*, Germ.; *Délitescence*, Fr.) of inflammation, which is in general connected with its simultaneous or speedy development in another organ. This recession depends on the succession of an irritation which is more severe than that which kept up the earlier inflammation. It is often merely a state *of changed vital activity*, of increased sensibility, which produces the removal of the inflammation, particularly if it be treated with repelling astringent remedies. Certain inflammations, as erysipelas, and critical inflammations, have a peculiar disposition to recede.

[The process of resolution has been well described by Dr. J. H. BENNETT, as follows:—"Resolution or absorption of the exudation may occur in various ways, and follow any of the transformations of the exudation except the one which converts it into permanent tissue. The early phenomena first disappear; the capillaries recover their contractility; the attraction between the blood and the parenchyma ceases; and the blood within the vessels begins to oscillate, and at length flows in a continuous stream. Secondly, the essential phenomenon disappears, no further exudation takes place, and that already poured out is absorbed. It occasionally, though rarely, happens, that the exudation does not coagulate for some time after it is exuded. Under these circumstances, when the early phenomena terminate, it re-enters the vessels by endosmosis, unchanged. In the majority of cases, however, it coagulates, and, once rendered solid, it could never be absorbed without the occurrence of changes in it by which it is again rendered fluid. This is effected by the formation, ripening and disintegration or decay (moulting process of SCHULZ) of nucleated cells, whereby the coagulated exudation is broken up, made soft, pultaceous, and diffluent, and at length absorbed. By this process exudation poured out into the lung or brain gradually disappears, by the production of inflammatory softening. On the serous surfaces the fluid and broken down corpuscles are absorbed; but that portion which passes into permanent organization, is transformed into fibrous tissue, becomes covered with a smooth membrane, so that the functions of the organ are not disturbed. Abscesses when resolved undergo a similar process. The pus-cells, instead of being evacuated, are brought closely together from the absorption of the more fluid portion (*liquor puris*.) These are gradually broken down, the cell-walls are dissolved, and the whole is reduced to a molecular matter, which re-enters the vessels, and thus complete resolution is produced. The disintegration of pus-corpuscles previous to absorption is evidently favoured by the pressure which the abscess receives from the contraction of the filamentous and elastic tissues that form its walls. * * * It is probable also, by increasing the contraction of the integuments, as well as by removing fluid from the neighbourhood of the part, that irritants, blisters and cauteries, are so beneficial in the resolution of abscesses. It is suggested by ZIMMERMAN, that the formation of an acid, as the lactic, in abscesses when fully formed, favours their disintegration. We have seen that acetic acid dissolves the cell-walls and causes the nucleus to appear in the form of granules: if lactic acid be produced, it would probably have the same effect. Alkaline solutions also, it is well known, dissolve pus-corpuscles, a circumstance that may explain the discutient effects of alkaline lotions and washes, and their beneficial operation in removing the incrustations from eruptive pustular diseases." (p. 63–5.)

As to the question "What becomes of the molecular fibrin which thus re-enters the circulation?" BENNETT states that "the observations of several German physicians, more especially of SCHÖNLEIN and ZIMMERMAN, have thrown much light upon it, and determined that the changes which the urine undergoes in acute inflammatory diseases, bear a relation to the absorption of exuded blood-plasma in internal organs. Thus, in a case of pneumonia, SCHÖNLEIN pointed out that the disappearance of dulness was accompanied by a turbid state of the urine, which contained a large amount of molecular fibrin, and was also highly coagulable by heat. ZIMMERMAN has recorded instances where the turbidity and coagulability of the urine bore a marked relation to the diminution of suppurative swellings. In some cases where purulent matter was apparently absorbed, he had observed that the urine was coagulable from the presence of fibrin dissolved in it" (*a*). Hence it is concluded "that the molecules of the broken-up exudation, after circulating in the blood, are frequently eliminated by the kidneys, and make their exit from the system by the urine, sometimes entire, at others in a state of solution. * * * Occasionally the excess of fibrin may be eliminated by the skin, lungs, and bowels. In all cases it constitutes an important symptom of the crisis." (p. 65.)]

8. Exudation (*Exsudatio*, Lat.; *Ergiessung*, Germ.; *Exsudation*, Fr.) is the outpouring of a larger quantity of serous fluid than the capillary vessels ordinarily exhale into the cellular tissue, into the parenchyma of organs, or into the cavities of the body. For the most part it occurs towards the end of the inflammation, or at least when it is subsiding. The fluid poured out (serum and coagulable lymph) differs in respect to its composition; often thin and transparent, often consistent, mingled with flocculi, and so on. The thicker part of this exudation (the coagulated albumen) not unfrequently unites neighbouring parts, vessels are prolonged into this interstitial substance, and *adhesion* is effected. If the fluid poured into the cellular tissue be only serous, then *dropsical swelling* (*œdema*) is produced. The exudation occurs, especially often in serous membranes: not unfrequently also does a similar exudation accompany inflammation of the mucous membranes. These exudations may be accompanied by an inflammatory or weakly condition of the capillary vessel.

[The term "exudation," as here explained by our author, is synonymous with "effusion," as generally employed by British practitioners; but the latter, by defining the nature of the matter poured out as effusion of serum, of coagulable lymph, &c., make a distinction which the former does not. Neither of these terms, however, thus used, seem sufficiently pointed; but their employment as proposed by J. HUGHES BENNETT is unobjectionable. "*Effusions*," he says, "no doubt are very common; but, in the great majority of instances, they arise from venous obstruction, altogether independent of inflammatory phenomena. * * * In all such cases the fluid is clear, holds no fibrin in solution, and on being evacuated shows no disposition to coagulate. * * * In inflammatory effusions, on the other hand, the fluid is more or less turbid, containing fibrin in solution, and, if allowed to stand, flocculi swim in it, or sink to the bottom of the vessel. * * * Mere effusion, then, cannot itself be considered as characteristic of inflammation. It may be the result of congestions non-inflammatory, or, if otherwise,

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(*a*) Ueber den gerinnbaren Harn; in CASPER's Wochenschrift, 1843, p. 345.

passes more or less into exudation. In every instance of undoubted inflammatory action an *exudation* of blood-plasma occurs which may be made visible. * * * Where the *liquor sanguinis* is poured out into shut cavities, the same phenomena occur as when blood is drawn from the body. The fibrin coagulates, and the serum is set free. The former then lines the serous membrane, and is denominated coagulable lymph, whilst the latter is called serous effusion. * * * In parenchymatous tissues, however, as in the lungs, liver, brain, &c., the structure of the parts will not allow of this distinct separation. The *liquor sanguinis* exuded is, of course, at first fluid, and, in this state, insinuates itself among the elementary structure of the organs, filling up every minute space. When it coagulates, the tissues of the part affected are completely blocked up, as if with cement. The blood-vessels, nerves, filaments, &c., are surrounded by a solid mass, in the same manner that the stones in a wall are surrounded by mortar." (pp. 38, 40.)

As to he effusion of serum, TRAVERS observes:—" The first change external to the vessels in inflammation is not a permanent change, and looks like a measure of temporary relief to the over-loaded vessels which surround the inflamed centre. It is an aqueous exudation from the colourless capillaries into the adjoining cellular texture. It would seem to be a passive mechanical effect, as it doubtless often is, but for the precedence of other unequivocal signs of inflammation." (p. 65.)

WHARTON JONES says:—" Immediately after or during the stagnation of the blood, exudation commences. From being at first serous the exuded fluid comes at last to be pure plasma, at least a fluid containing a greater or less quantity of fibrin." He attributes the exudation " to the thinning of the walls of the vessels, from their relaxation and dilatation on the one hand and the pressure from within the vessels on the other:" and he also suggests, as likely to promote exudation, " that the plasma will be pressed out from among the aggregating corpuscles, even when the blood would not, if out of the body, present the buffy coat, and that because within the body the fibrin of the plasma does not so readily coagulate;" but, when the blood is so changed that on abstraction the buffy coat appears, " the plasma at the same time that it is more quickly and energetically squeezed out from among the aggregating red corpuscles, will present itself in greater quantity and richer in fibrin, for transudation through the walls of the capillaries." He considers, with WATSON, that the cause of serum alone passing out first, " is, as in common œdema, owing to obstruction; the obstruction in inflammation being from the stagnation of the blood;" but how obstruction determines exudation of serum alone, remains a question: to help to a solution of this, it may be stated that, according to KÜRSCHNER, water passes most quickly through animal membranes and saline solutions more quickly than viscid, gummy, and albuminous solutions. With exudation," he says, " is completed the inflammatory process properly so called." (pp. 584, 5.)

" The extravasation of the serum along with the coagulating lymph," says JOHN HUNTER, " is, probably, not a separation of itself, as in a dropsy; but, a part of it being separated from the lymph in the coagulation of that fluid, is squeezed into the surrounding cellular membrane, where there is but little extravasation, and where the cells are not united by it. Thus, the circumference of such swellings is a little œdematous; but the whole of the serum if there be a depending part will move thither, and distend it considerably, as in the foot in consequence of an inflammation in the leg. But, in most cases, there is a continued extravasation of serum long after the extravasation of the coagulating lymph is at an end, so that depending parts will continue œdematous, while the inflammation is resolving, or while suppuration, or even healing, is going on. The whole swelling looks like a part of the body only a little changed, without any appearance of containing extraneous matter; and indeed it is simply formed by an extravasation of fluids without their having undergone any visible or material change, except coagulation." (p. 285.)

GERBER speaks of the exudations after inflammation as *watery* or *serous* exudation when merely the serum of the blood is poured out; *plastic*, when the *liquor sanguinis* containing fibrin exudes without the blood-corpuscles; and *sanguineous*, when it is blood-coloured; the colour depending either on solution of the colouring matter of the blood, or the effused *liquor sanguinis* contains all the components of the blood and even the blood-globules, thus forming the transition to hæmorrhage (p. 42.) He says, also, that in the fluid of *serous exudations* albuminous granules of albuminous fluids are usually found; that after *plastic exudations* a yellowish turbid fluid is found in the affected cavity, with fine pale yellow flocculi floating in it, or precipitated upon and perhaps adhering to the walls of the exuding surface. If the exudation of plastic matter go on longer, and the quantity of effused *liquor sanguinis*, be considerable, the cavities may be filled with it; their walls and the organs they include may be covered with thick layers of fibrin, which at first is of a pale yellow hue and somewhat transparent, with the consistency of imperfectly coagulated albumen. If death then occur, this hyaline substance quickly becomes granular, and, in consequence of chemical decomposition, is dissolved in the serum; but, if life continue, the characters of the exudation are otherwise altered (p. 42;) which alteration he proceeds to describe as follows:—"The separated serum is gradually absorbed whilst the fibrin floating in it is dissolved. The fibrin which is attached, on the other hand, becomes of a chrome-yellow colour, and, if examined under the microscope, is found to consist of a connected exudation of corpuscles, which are found in form twenty-four to thirty hours after the exudation, when the mass is of an orange yellow, and has acquired such consistence as to be stripped off the membrane in slips. * * * The exudation-corpuscles are in every respect the same as the lymph-corpuscles; they generally form many superimposed layers, being laid flat one over another, and so constituting membranes which completely resemble the tessellated epithelium when the connecting medium has disappeared, so that the edges of the primarily round corpuscles thrust against each other, and are thus rendered polygonal." Subsequently the cohesion increases, and a more fibrous structure is indicated, and "under the microscope an ever-increasing linear arrangement of the exudation-corpuscles, which are more intimately united at two opposite points in one line, by means of the connecting cyto-blastema than any where else, is apparent. The original globular cyto-blasts now assume a spindle-like form, and the flat ones continue more flatted as their margins have become more spindle-shaped, and in their linear connexion form varicose fibres, at the enlargements of which the nucleus of the exudation-corpuscle continues visible, and either subdivides into several granules, or a new nucleolus is formed within it. Between these now formed cellular fibres there still remains an inter-cellular hyaline substance, so that the masses may be separated mechanically in any direction." (p. 434.)

VALENTIN (*a*) describes the exudation-corpuscles as "like so many embryonic nuclei —round, granular, and lying tessellated one upon another, whilst their very small interstices contain a transparent gelatin." (p. 215.)

GULLIVER (*b*) differs from GERBER as to the similarity between the exudation and lymph-corpuscles. "In mammiferous animals," he says, "it has always appeared to me that the lymph-globules differ in size, structure, and chemical characters from exudation-globules. The latter are larger, more irregular in size and shape, more spongy or loose in texture than the former;" generally exhibit two or three nuclei when treated with acetic acid, whilst the lymph-globules are only rendered slightly smaller by it. The acid either dissolves or makes remarkably fainter the comparatively thick shell of the exudation-corpuscle, while the lymph-globule becomes more distinct when subjected to the action of the acid." * * * "The lymph-globules, in fine, in progress of development, may soon become more or less coated with fibrin; but, if examined at an early period, they will be found to resemble in chemical characters the nuclei (nucleoli of VALENTIN) of primary cells." (p. 83.)]

9. Suppuration (*Suppuratio*, Lat.; *Eiterung*, Germ.; *Suppuration*, Fr.) is, when resolution does not ensue, the suitable termination of simple inflammation, and, if that be severe, it appears the natural result; therefore, a *fully developed simple inflammation* is termed, by some, *suppurative inflammation.* The pus is secreted through the walls of the capillary vessels, not, however, immediately as such, but is first formed by the changes which the inflammatory exudation undergoes; the coagulated fibrin is gradually converted into pus-globules, which then mix with the serum. Pus is formed of all the components of the blood, the colouring matter excepted, and especially from its albumen and fibrin. If it collect in the cellular tissue, *Abscess* (*Eitergeschwülste*, Germ.; *Abcès*, Fr.) is produced. The process of suppuration is a true secretion, and the vital condition of the organs influences it as well as all other secretions. There is usually no destruction of tissues connected with suppuration. That we often find the remnants of destroyed cellular tissue in pus, or that the skin

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(*a*) See his "Principal Features in the Development of the Animal Tissues," in WAGNER's Elements of Physiology, translated by R. WILLIS, M.D.

(*b*) His notes in the Translation of GERBER.

covering the abscess is destroyed, depends on accidental circumstances—in the great distension of the cellular tissue and skin, or in the suppuration, from general or local mischief, passing into *Ulceration* (*Verschwärung*, Germ.; *Ulcération*, Fr.) These remnants of destroyed cellular tissue must not be confounded with the *cores* (*Eiterpropfröpfen*, Germ.) so called *sloughs*, which are found in the midst of the inflamed cellular tissue, at the commencement of suppuration, in the form of white jelly-like semi-transparent stringy flocks, which have no trace of organization, are at first firmly connected with the surrounding cellular tissue, but subsequently are thrown out with the pus. These cores are tough concretions of coagulated albumen.

The various opinions relating to the formation of pus may be arranged in two classes:—1. It was supposed that pus was formed and secreted within the vessels of inflamed organs by the peculiar activity of the former. 2. That pus was produced externally to the vessels of the inflamed organs, either in the solid parts in a state of inflammation, or in the effused fluids undergoing a change similar to that of fermentation or putrefaction. According to the former opinion suppuration must be considered as a vital, according to the latter as a chemical, process. The formation of pus as a secretive process first published by SIMPSON (*a*), more fully discussed by DE HAEN (1756,) and by MORGAN (*b*), was specially and more accurately proved by HUNTER, by BRUGMANS (*c*), and by PINEL. Upon the other supposition BOERHAAVE ascribed the formation of pus to the dissolving of the hard parts and the changes which take place in the effused blood; BELL and others to the putrefaction of the serum; GOTTER and QUESNAY, to the change in the coagulable lymph; HOFFMAN and GRASHUIS, to the decay of the fat; and STEWART to putrefaction of the chyle.

The process of the pus formation and the nature of pus, besides the above-mentioned writers, most meritoriously occupied PEARSON (*d*), HEWSON (*e*), E. HOME (*f*), BERZELIUS (*g*), GRUITHUISEN (*h*), and have been recently examined with the greatest care; FISCHER (*i*) has furnished observations on its chemical composition; DONNE (*k*), GLUGE (*l*), and VALENTIN (*m*) have enriched our knowledge of its microscopic elements; GUTERBOCK (*n*), WOOD (*o*), BONNET (*p*), and MANDT (*q*) have, in a chemical and microscopical view, furnished correct observations, which VOGEL (*r*) for the most part arranged and increased with the results of his own observation. Compare also VOGEL (*s*) and E. V. BIBRA (*t*).

10. The transition of inflammation into suppuration is probable—when the inflammation is active and quickly reaches an acute stage; when the pain is severe, the distension and swelling are considerable, the inflamed part of a lax character, and surrounded with much cellular tissue (1). If the inflammation continue longer than usual, without showing critical movements, if the pain becomes throbbing, the redness and swelling diminish without entirely disappearing, the swelling becomes softer, and the patient has a shiver, then the formation of pus has commenced; the swelling becomes still softer, is elevated in the middle, and sunk at its circumference,

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(*a*) Disput. de re Medicâ, 1722.

(*b*) Tentamen Medicum de Puris confectione. Edinb. 1756.

(*c*) Diss. de Puogeniâ. Groenig. 1785.

(*d*) Observations and Experiments on Pus, in Phil. Trans. 1810, p. 294.

(*e*) In his Experimental Inquiries, Part the Second, containing a description of the Lymphatic System, &c., p. 117. London, 1774. 8vo.

(*f*) A Dissertation on the Properties of Pus. London. 1788. 4to.

(*g*) Article "Pus," in his Traité de Chimie, traduit par M. ESSLINGER sur des Manuscrits inédits de l'Auteur et sur la dernière édition Allemande, vol. vii. p. 635. Paris, 1833. 8vo.

(*h*) Naturhistorische Untersuchungen über den Unterschied zwischen Eiter und Schleim. München, 1809.

(*i*) De Puris indole ejusque à pituitâ discernendi Methodis. Dorpat. 1836.

(*k*) Archives générales de Médecine. 1837, Août.

(*l*) CASPER's Wochenschrift. 1843.

(*m*) Repertorium für Anatomie und Physiologie, 1837. Part ii. p. 197.

(*n*) De Pure et Granulatione. Berol., 1837.

(*o*) De Puris naturâ et formatione. Berol., 1837.

(*p*) Mémoire sur la composition et l'absorption du Pus; in Gazette Médicale de Paris, 1837. No. 38.

(*q*) Ueber den Eiter, den Schleim, und die verschiedenen Ergüsse; in SCHMIDT's Jahrbücher, 1838, No. 19, p. 274.

(*r*) Physiologisch-pathologische Untersuchungen über Eiter, Eiterung, und die damit verwandten Vorgänge. Erlangen, 1808.

(*s*) In WAGNER's Handwörterbuch der Physiologie, etc.

(*t*) Chemische Untersuchungen über verschiedene Eiterarten und einige andere krankhafte Substanzen. Berlin, 1842.

and on touching it *fluctuation* (*Schwappung*, Germ.) is felt. In order to be assured of this, the fingers may be pressed alternately upon the swelling, or, what is preferable, the finger or the flat hand may be laid on the side of the swelling, while this is gently tapped with the fingers upon the other, by which the undulations of the pus are communicated to the hand. The skin becomes transparent at the most elevated part, and the pus is seen through it; finally, the skin breaks by the process of continued absorption, and the pus is discharged. If the parts covering the abscess are unyielding, an extension of the suppuration takes place in various directions before it makes its way out (2). If the inflammation be slight, it often continues a long time without exhibiting any disposition to break. It is often very difficult to distinguish the transition to suppuration in inflammation of deeply situated or in internal organs. The usual appearances are—the symptoms of inflammation subside without crisis, the part does not return to its natural functions; it feels to the patient heavy, oppressive, or cold; he has frequent shiverings; the appearances of hectic fever set in, burning heat of the hands and soles of the feet, especially after eating, circumscribed redness of the cheeks, emaciation, night-sweats, purgings, and so on. Deep-seated fluctuation is felt, or the surface of the part exhibits an œdematous swelling. The symptoms of hectic fever accompany every considerable suppuration, and it is probable that this must be ascribed partly to the loss of the albumen and fibrin of the blood, and partly to the absorption of pus.

The circumscription of the pus in the cavity of the abscess depends upon the effusion and coagulation of the plastic lymph, which occur during inflammation, whereby a cavity with smooth walls is produced, in which the capillary vessels are very strongly developed, so that the pus is shut off from the other cellular tissue, and its spreading from cell to cell is prevented. In cases in which the inflammation is not connected with plastic exudation this circumscription of the abscess does not take place; for instance, in many erysipelatous inflammations. If suppuration occur on the surface of serous membranes, there must always be first produced a considerable development of vessels. In structures which are very highly vascular, suppuration occurs more rapidly. The walls of the abscess must be considered as *secreting* and *absorbing* surfaces. In the resorption of pus, (by the veins and lymphatic vessels,) it is mixed with the blood and separated from it by the colatories of the body, specially the lungs and kidneys, or is deposited in the tissue of parts (metastatic abscesses;) it is, however, undetermined whether the pus is deposited as such or is produced by the after-changes which commonly occur in the inflammatory exudation (Vogel.) As the pus-corpuscles are larger than those of the blood, they cannot pass through the capillary vessels, and therefore only the serum of the pus is absorbed, or the pus-corpuscles are broken down, and can then also be absorbed. We must not confound with this the entry of pus into a torn vein, or its formation by phlebitis in the vein and its further passage onwards with the blood. In regard to the operation of absorbed pus, Bonnet supposes that the absorption of good, cream-like pus, which has not been changed by the action of the air, will not produce any peculiar symptoms, because with it nothing enters into the blood but what is natural to it; but, if in depraved putrid pus hydrosulphate of ammonia be developed with a residue of ammonia, and be absorbed with the serum or pus, a septic poison is introduced into the blood, the presence of which has been ascertained by Bonnet in the blood, and its separation in the urine.

[(1) "The true inflammatory disposition and action," says Hunter, "almost immediately ceases upon the commencement of suppuration; and, although the vessels may be nearly in the same state, yet they are in a much more quiescent state than before, and have acquired a new mode of action." * * * And he asserts, "as an invariable fact, that no suppuration takes place which is not preceded by inflammation; that is, no pus is formed but in consequence of it." * * * "The immediate state of parts which may be called the immediate cause of suppuration, I conceive to be such as cannot carry on its usual functions of life, and which state of parts I have called the state of imperfection, let the cause of that state be what it will; we have shown that irritation simply is not always sufficient, it often only brings on the adhesive stage, which is in most cases intended to prevent the suppurative." (p. 372.) " In spontaneous suppurations, one, two, three, or more parts of the inflammation lose the power of resolution, and assume exactly the same disposition with those of an exposed surface, or a surface in contact with an extraneous body. If it is in the cellular membrane that this disposition takes place, or in the investing membranes of circumscribed cavities, their vessels now begin to alter their disposition and mode of action, and continue changing till they gradually form themselves to that state which fits them to form pus; so that the effect or discharge is gradually changing from coagulating lymph to pus: hence we commonly find in abscesses both coagulating lymph and pus, and the earlier they are opened, the greater is the proportion of the former." (p. 378.)

" Should the exudation become purulent, this gelatin (viz. that which is interstitial to the corpuscles) acquires fluidity," says Valentin, " and the plus globules then swim in the *liquor puris*, sink tessellated to the bottom, and surround themselves with cells, which subsequently undergo tranformation in accordance with certain laws into exudation fibres or exudation membranes." (pp. 215, 216.)

" This (suppurative) inflammation has symptoms common to inflammation in general; but," says Hunter, " it has these in a greater degree than the inflammation leading to it, and has also some symptoms peculiar to itself: * * * it gives as much as possible the idea of simple pain without having a relation to any other mode of sensation: * * * the pain is increased at the time of the dilating of the arteries, which gives the sensation called throbbing, * * * perhaps one of the best characteristics of this species of inflammation. [This observation, as already noticed, (p. 23,) is incorrect.—J. F. S.] When the inflammation is moving from the adhesive state to the suppurative, the pain is considerably increased (and which would seem to be the extent of this operation in the part;) but when suppuration has taken place the pain in some degree subsides. * * * The redness that took place in the adhesive stage is now increased, and is of a pale scarlet: this is the true arterial colour, and is to be accounted a constant symptom, as we find it in all internal inflammations, when at any time exposed, as well as in those that are external." The dilatation of the old vessels, and the formation of new ones, which had occurred in the first or adhesive state of the inflammation, " are here carried still further in the surrounding parts, which do not suppurate, and constitute two other causes of this redness being increased by the vessels becoming more numerous, and the red part of the blood being pushed more forward into many vessels, where only the serum and coagulating lymph went before. The part which was firm, hard, and swelled, in the first stage, now becomes still more swelled by the greater dilatation of the vessels and greater quantity of extravasated coagulating lymph thrown out in order to secure the adhesions. The œdematous swelling surrounding the adhesive gradually spreads into the neighbouring parts. * * * There is a certain period in the inflammation, when the suppurative disposition takes place, which is discovered by new symptoms taking place in the constitution, viz. shivering." (p. 377–79.)

" The vessels are but little changed from the adhesive state at the commencement of the suppurative disposition; so that they still retain much of the form they had acquired by the first state, the discharge being at the beginning little more than coagulating lymph, mixed with some serum. This is scarcely different from the adhesive stage of the inflammation; but, as the inflammatory disposition subsides, the new disposition is every instant of time altering those vessels to their suppurative state; the discharge is also varying and changing from a species of extravasation to a new formed matter peculiar to suppuration; this matter is a remove further from the nature of the blood, and becomes more and more of the nature of the pus; it becomes whiter and whiter, losing more and more of the yellow and green which it is apt to give the linen that is stained with it in its first stages, and in consistence more and more viscid or creamy." (p. 415.)

John Hunter describes that as " an abscess *in* this part," *i. e.* when " collections of matter are found in parts where not formed, more especially in the deeper-seated ones, the matter moving from the seat where it was formed to some more depending part, or, having met with some obstruction in its course, it takes another direction;" whilst " abscesses which are commonly formed where matter is found, especially the more superficial ones, may be justly called abscesses *of* this part. (p. 510.) " Suppuration takes place much more readily in internal canals than internal cavities; * * * more readily upon the surface of canals than in either the cellular or investing membrane. The same cause which would produce a suppuration in the first parts (the canals) would only produce the adhesive in the other (the cavities.)" (p. 377.)

"The cavity (of the abscess,)" observes **Travers**, "is surrounded by an effusion, and lined by a pellicle of lymph (pyogenic membrane,) whence the pus is furnished." (p. 125.) "The aspect of the suppurating membrane varies to such extent as scarcely to exhibit, in some circumstances and situations, the granular form, *e. g.* upon the walls of abscesses, and upon the free surfaces of mucous and serous membranes; but the fibrinous bed and the capillary loop of new formation, and a corresponding alteration of the pus-secreting surface from its normal state will always be detected upon careful examination, being essential elements of the suppurative process." (p. 111.) "A section of an abscess, from circumference to centre, presents the condensation of the wall by the deposit occupying the cells of the cellular membrane, the secreting membrane, the semi-solid flakes of lymph, and the collection of pus forming its contents; the arrangement, appearance, and proportion of each varying according to the stage of the suppuration." (p. 125.)

(2) Of the circumstances upon which depends the determination of abscess to the surface, the following very interesting account is given by John Hunter:—"An internal pressure, produced by an extraneous body, acts equally on every side of the surrounding parts, and, therefore, every part being pressed alike, ought from this cause alone to produce absorption of the surrounding parts equally on all sides, supposing the parts themselves similar in structure, or, which is the same, equally susceptible of being absorbed; but we find that one side only of the surrounding living parts is susceptible of this irritation: therefore, one side only is absorbed; and this is always the side which is next to the external surface of the body. * * * From this cause we find abscesses, &c., whose seat is in or near the centre of a part, readily determined to the surface on the one side, and not on the other; and, whenever the lead is once taken, it immediately goes on." (p. 448.) He also observes:—"We find that the absorption of whole parts more readily takes place, to allow an extraneous substance to pass out of the body than it will to allow one to pass in. Thus we see that the slight pressure produced by matter on the inside of an abscess has a great effect, and the matter is brought much faster to the skin (although very deep) than it would by the same quantity of pressure applied from without; and, indeed, so slight a pressure from without would rather tend to have an opposite effect, namely, that of thickening. The reason of this is evident: one is, a readiness in the parts to be freed from a disease already existing; the other is a backwardness in the parts to admit a disease. This principle, therefore, in the animal economy produces one of the most curious phenomena in the whole process of ulceration, viz. the susceptibility which the parts lying between an extraneous body and the skin have to ulcerate, while all the other side of the abscess is not irritated to ulceration; and the necessity there is that it should be so must be very striking; for, if ulceration went on equally on all sides of an abscess, it must increase to an enormous size, and too great a quantity of our solids must necessarily be destroyed." (p. 449.)

But mere pressure is not, according to Hunter's views, sufficient for bringing the contents of an abscess to the surface; "there is an operation," says he, "totally distinct, and this is a relaxing and elongating process, carried on between the abscess and the skin, and at those parts only where the matter appears to point. It is possible that this relaxing, elongating, or weakening process may arise, in some degree, from the absorption of the interior parts; but there is certainly something more, for the skin that covers an abscess is always looser than a part that gives way from mere mechanical distension, excepting the increase of the abscess is very rapid." (p. 460.) **Travers**, in commenting upon this point, observes:—"Whether the tendency of matter to the nearest surface, external or internal, the outer or inner integument, as the case may be, is due to the more yielding structure of parts in the direction of the nearest surface or to the operation of a physical law, as the increased amount of pressure from the increased area of the summit over the base, I cannot determine." (p. 188.)]

11. Pure good pus (1) is an opake, tolerably consistent, yellowish white fluid, with a peculiar smell when fresh, which it loses on cooling, and of a sweetish taste, specifically heavier than water, (spec. grav. 1,030,) (2), not readily subject to putrefaction (3); reacts in its fresh state as an alkali; but, after a time is neutral or acid, probably because during its decomposition it forms acetic acid; and under the microscope is seen to consist of *fluid parts* and *globules* (4) which can be separated by straining (5); but very frequently this separation occurs spontaneously if the pus be left alone.

[(1) Pus "is formed from some change, decomposition, or separation of the blood which it undergoes in its passage out of the vessels, and for effecting which the vessels of the part have been formed, which produces a subsiding of the inflammation from which it took its disposition. * * * In order to carry on the decompositions and combinations necessary for producing this effect, either a new or peculiar structure of vessels must be formed or a new disposition, and of course a new mode of action of the old must take place. This new structure or disposition of vessels I shall call glandular, and the effect or pus a secretion." (pp. 415, 416.)

"The purpose which the formation of pus serves in the economy is," says **Travers**, "in conjunction with another act of inflammation, to open a communication with a contiguous surface, either for the purpose of liberating matter incapable of organization, and therefore superfluous or hurtful; or as indispensable to reconstruction or the effacement of lesions by granulation. (p. 118.) The continuance of inflammation, beyond the term required for union in simple solutions of continuity, in cases which are beyond reparation by the direct adhesive process, and in phlegmon or adhesive deposit unaccompanied by external lesion, entails an addition of the suppurative to the adhesive action. (p. 124.)

(2) The principal peculiar qualities of pus are its colour and consistence; but it appears that the colour takes its rise from the largest portion of the whole mass being composed of very small round bodies, very much like those small round globules which, swimming in a fluid, make cream. "I should suppose," says **John Hunter**, "those round globules to be white in themselves as cream would appear to be, although it is not necessary that the substances of matter which reflects a white, should be itself white. * * * These globules swim in a fluid which we should at first suppose to be the serum of the blood, for it coagulates with heat like serum, and most probably is mixed with a small quantity of coagulating lymph; for pus in part coagulates, after having been discharged from the secreting vessels, as mucus is observed to do; but, although it is thus far similar to serum, yet it has properties the serum has not." The fluid part of the pus would not coagulate on the addition of the gastric juice, or of solutions of neutral salts, but only with sal ammoniac, (hydrochlorate of ammonia,) "which would not coagulate any other of our natural juices." The proportion of the white globules in the pus "depends on the health of the parts which formed it; for, when they are in a large proportion the matter is thicker and whiter, and is called good matter." * * * Pus is specifically heavier than water: it is probably nearly of the same weight with blood or any other animal substance rendered fluid. It has a sweetish and mawkish taste, probably from having sugar in it, which is very different from most other secretions. It has a smell in some degree peculiar to itself." (p. 428-9.)

(3) With reference to the putrefaction of pus, **Hunter** observes:—"Pus, from several circumstances often attending it, would appear in general to have a greater tendency to putrefaction than the natural juices have; but I very much suspect that this is not really the case with pure pus, for, when it is first discharged from an abscess, it is in generally perfectly sweet. There are, however, some exceptions to this; but these depend on circumstances entirely foreign to the nature of pus itself," (p. 434,) of which he instances the communication of the air with the interior of an abscess; the nearness of an abscess to the feculent contents of the colon, or rectum, when blood is contained in abscess resulting from external injury, or when part of the solids mortify from the same cause, and the like; "in all such circumstances we find the pus has a greater tendency to putrify than the pure or true pus," which, "although easily rendered susceptible of change by extraneous additions, is in its own nature pretty uniform and immutable. It appears so unchangeable that we find it retained in an abscess for weeks, without having undergone any change; but these qualities belong only to perfect pus." (p. 435.) Pus from sores, he remarks, is subject to the same changes under similar circumstances. **Gulliver** also states, that he has had healthy pus "in a window, to which the sun had access for six weeks, without becoming fetid, and, if carefully washed of all impurities, it will continue sweet for an almost indefinite time" (*a*.)

(4) **Thomson** says the globular structure of pus was first mentioned by **Senac** (*b*). The following is, I presume, the passage to which he refers:—"The globules of pus are similar to those of the blood: such as are seen in the matter of which gonorrhœa consists are larger, whilst those which form the pus of ulcers are smaller and more unequal in size: but this figure does not give redness to these globules; they are white, and this whiteness is constant." (p. 659.)

John Hunter describes as "the peculiar character of pus, globules swimming in a

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(*a*) Med. Gaz., N. S., vol. ii. p. 312. 1839-40.

(*b*) Traité de la structure du Cœur, et son action et de ses Maladies, vol. ii. Sup. Paris, 1749. 4to.

fluid which is coagulable by a solution of sal ammoniac, (hydrochlorate of ammonia,) which no other animal secretion he knew of is." (p. 421.)

(5) This does not accord with Gueterbock's (*c*) observation, who says, that "Pus of every kind and from any part may be separated into two parts, into a liquor and a substance, not soluble in it, but only suspended, rendering the pus turbid, and tinging it yellow; which, however, I could not completely separate by straining, although the most different papers were used. For the fluid always flowed turbid, and the paper through which I strained being obstructed, the pus, diluted with water, began in a short time to putrify. But, if you allow it to remain for a longer time in one vessel, you will find a supernatant yellow fluid, the greatest part of which, as will be shown hereafter, consists of albumen." (p. 8.)]

12. The fluid (serum) of pus shows no trace of globules: it exhibits all the signs of albumen dissolved in water, which is distinguished, like the serum of the blood from the white of fowls' egg in not being thrown down by æther. This fluid also contains *fat*, *osmazome*, *acetic acid*, perhaps also *lactic acid*, *hydrochlorate of soda*, *of potash*, *of lime*, *of ammonia*, (Bonnet,) *phosphate*, *sulphate*, *and* probably also *acetate and lactate of soda*, *phosphate of magnesia and lime*, *a trace of iron and silica.*

Henle (*a*) found free fat, recognisable by the microscope, in form of fatty vesicles.

Whether many substances which are found in pus, such as pyine, gluten, &c., are proper constituents of that fluid seems still doubtful; as also whether the iron is not to be ascribed to some admixture of blood.

[Gueterbock has entered into the chemical analysis of pus at very considerable length, (pp. 11, 19,) and he describes "a new substance of peculiar character," to which, "although found not only in pus, but also in mucus, without any intermixture of pus, and in tubercular matter, he gives the name *pyine*, (from *πυος*, *i. e.* formed of pus,) because he first discovered it in pus." (pp. 12, 13.) In the translation of Gerber's Elements of General Anatomy (pp. 97, 100) will be found the analyses of Vogel, J. Martius, Gueterbock, Kock, Goebel, and Dumas.]

13. The globules of pus vary in quantity, sometimes a larger, sometimes a smaller number being present; the thicker and better the pus, the more numerous are the globules. They are of two kinds; the larger have a diameter of 0,0004—0,0005 of a Paris inch; are of pretty uniform size, usually tolerably round, rarely of irregular form: most of them have an irregular surface, so that they appear as if covered with still smaller globules; they are more transparent and less coloured than blood-globules. Between these larger globules swim about a smaller quantity of little granules, rarely as large as blood-corpuscles. If the larger pus-corpuscles are for some time in contact with water, they become more transparent towards the edge, darker in the middle, and the same in spirits of wine. In acetic acid the envelope becomes transparent, finally dissolves, and leaves behind a nucleus consisting of one, two, or three corpuscles of 0,0001 of a Paris inch in diameter, many of which have a central indentation. Sometimes also the envelope bursts, and the nucleus is set free by shaking or rubbing. The envelope consists of albumen.

According to Mandt (as above) the larger pus-globules, in respect to their size form, appearance, and their relation to chemical agents, exhibit a perfect accordance with those globules which the coagulated fibrin presents, either in inflammatory buff, in false membranes, or in the fibrils, which fibrin forms when the blood is shaken about with albumen. Mandt applies to these globules the name *fibrin-globules*, because they owe their existence to the coagulated fibrin which is secreted from the blood and external to the vessels. The second kind of globules, the diameter of which varies from $\frac{1}{400}$ to $\frac{1}{500}$ of a millimètre, and which are mixed with the pus-globules, belong to the globules of albumen coagulated by the salts of the serum: they are, therefore, more

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(*a*) De Pure et Granulatione Commentatio Physiologica. Accedit Tabula ænea. Berol., 1837. 4to.

(*b*) Symbol ad Anat. vill. Berol., 1837, p. 24, *note*.

numerous as the serum is more rich in salts. They are frequently found among fat-globules of different diameters.

[GUETERBOCK appears to be the first who discovered the different size of the globules in pus; he says:—"All writers who have hitherto examined pus, KALTENBRUNNER (*b*) alone excepted, (who mentions that he has seen corpuscles and granules swimming in the pus of frogs, although in pure human pus, carefully preserved from the air, he states that he has sometimes seen granules of equal size, (p. 16,)) speak of the globules swimming in pus as of only one kind. I have, however, always seen globules of vastly different size in pus, of which only the largest have been noticed by writers, even by GRUITHUISEN and E. H. WEBER. Although these exist in the greatest number in pus, yet it is not to be doubted that smaller ones swim among them. The proportions of the globules and liquor vary in every kind of pus, so that the greater be the number of globules the thicker and better is the pus, and *vice versâ.*" (p. 8.) The size and form of the globules and granules given by CHELIUS are those stated by GUETERBOCK, who, subsequently comparing the globules in pus with the corpuscles of other animal liquors, says:—"They are most like the globules I have found in mucus, but more irregular, unequal, and of much less number, most of which are of the same size, and some even larger than the pus-globules, as I have frequently by repeated observations ascertained, notwithstanding E. H. WEBER contends they are only half as large. Like the pus-globule, they also contain a nucleus, consisting of granules. I have sometimes seen globules of the same form and nature swimming in the saliva; but at other times I have measured them twice and thrice as large. Mixed with water, they quickly swell and are decomposed. Finally, the pus-globules differ from the blood-corpuscles, not only in size, but also in chemical properties, since the envelope of the former is dissolved by both water and acetic acid, whilst that of the latter is dissolved only by the acetic acid." (p. 11.)

The following is the account which GUETERBOCK gives of the chemical nature of the pus-globules, which he obtained from a wound in a horse:—"The globules having been most carefully washed, and had concentrated acetic acid poured over them, were strained. In straining the envelopes of the globules were dissolved. On adding a solution of the ferro-hydro-cyanite of potash, a sediment was produced: the one part of it neutralized by the carbonate of potash was first rendered turbid and then precipitated, whence I conclude that the envelope is to be included among the number of those substances which, named by BERZELIUS albuminous, are precipitated by the ferro-hydro-cyanite of potash. But the granules forming the nuclei of the globules are not dissolved by acids. I cannot yet certainly state whether, like the corpuscles of the blood, they are dissolved by the liquor of caustic potash, though it seems to me very probable that they are; for the liquor of caustic potash (or even the concentrated carbonate of potash) being added, the pus-globules become more transparent, and are less perspicuous, some after a certain time vanish, rudiments of the envelopes and granules being here and there left." (p. 10.)

The pus-globules described by MAYO (*a*) as "occasionally seen in the blood of healthy persons," the only person in whose blood he had not found them being an aged woman of seventy-seven years, though he admits that "nevertheless they differ to a certain extent from the globules which are seen in pus from an ulcerated sore," GULLIVER (*b*) denies being pus-globules at all, and says they are probably the large white globules of the blood spoken of by MAGENDIE and Dr. DAVY.

The following is GERBER's account of the formation of pus, and of the reproductive organization in suppurating wounds:—"A continual oozing of *liquor sanguinis* takes place on the surface of the wound; the coagulating fibrin forms exudation-corpuscles, which are partially disposed in layers on the wounded surface to form the exudation-membrane, and the layers nearest the living surface are converted into cells, which become further and differently organized according to the nature of the tissues to be reproduced. The cytoblasts or exudation-corpuscles most distant from the wounded surface become pus-corpuscles, which, with serum, form true pus, which on the one side covers the seat of organization, separates the so-called granulating surface from external influence, and on the other forms that soft, mild, peculiar medium in which reproduction proceeds from the wounded surfaces towards the middle of the wound, and by which foreign substances are washed out of the wound.

"*Pus.* The exudation-corpuscles lying beyond the living influence of the wounded surface, but exposed to external agency, cannot retain their life for any length of time, and,

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(*a*) Observationes quædam microscopicæ in partibus animalium pellucidis institutæ de inflammatione. Dissert. inaug. Berol., 1835.

(*b*) Medical Gazette, 1839, 40, p. 128. (*c*) Ib. p 201.

forsaken by the organizing principle, degenerate in their organic formation, and their organic chemical blending; whilst those in contact with the living surfaces of the body, proceed in their further organization: thus, by the death of the former, is given life to the latter (*mors vitæ origo.*)

"Upon the free exudation-corpuscles first appear delicate radiating lines, which divide their periphery into six or eight (rarely more) segments: these lines become more decided, and the capsule appears as if torn, though without any solution of continuity. In some even the nucleus seems inclined to break into from two to four pieces. At the same time the originally reddish-yellow fluid fades, the divided segments of the capsule and the divisions of the nucleus, which were distinctly linear, become rounded into cohering granules, whilst the now perfectly formed pus is of a greenish colour. The true pus-corpuscles thus formed, are still here and there connected together, (the pus-membrane,) like the cells of tessellated epithelium; are specifically heavier than the serum; appear under the microscope somewhat larger than lymph-exudation and blood-corpuscles (from $\frac{1}{300}$ to $\frac{1}{170}$ of a Paris line in diameter;) are of a yellowish colour, and mingled with oil-drops and albuminous granules, with which last they are commonly besprinkled, and which are by many considered as integral parts of the corpuscles, they overlooking the usual large granules which in their connexion with the pus-corpuscles are so attached that the latter at first appear as lenticular, or cake-like quilted cushions. Subsequently the granules separate still more, so that the corpuscles are resolved into their elements; old pus therefore consists for the most part of these more or less isolated granules. * * * The younger the pus, the greater the quantity of fibrin (transition-cytoblasts) and the older it is, the more fat does it generally contain. Thus, in the degeneration of its organization, from its commencement to its perfection, is it remarkably opposed to chyle, in reference to its organic and chemical relations." (pp. 47, 48.)

"*False Pus.* Secreted and exuded fluids very frequently occur in man and beasts, which without closer—that is, microscopic—examination, may be taken for pus, because they look very like it, and chemically often do not differ much from it, and yet are produced in another way, and are of different nature. On the contrary, substances are deposited and thrown out which seem very different from pus, and yet are either true pus, or very nearly allied to it.

"It is the above-described fluid alone, the true or proper, the so-called laudable pus, which is a necessary condition of reproduction: therefore I call it *reproductive pus;* and, as the corpuscles usually consist of seven granules, they may also be called septengranular pus-corpuscles. Previous to their division, these corpuscles always belong to the nucleated corpuscles; they are degenerating cytoblasts. In this constant quality of the true pus-corpuscle is the most certain criterion for distinguishing pus from other more or less similar fluids; and that fluid which contains no such corpuscles, or with them any corpuscles or deposit which do not exist in the pus of healthy wounds, is either not pus, or not pure pus." (pp. 53, 54.)

The following are TRAVERS's views on the constitution of pus:—"Pus, I believe," says he, "to obtain its characters of consistency, opacity, and colour after exudation, and to consist of the superfluous or waste lymph which has been separated during the adhesive stage from the mass of blood held in solution by the serum, being thus a chemical modification of the constituents of the *liquor sanguinis;* in short, the latter fluid deprived of its original character and property of spontaneous coagulation. Pus particles resemble those of lymph seen in the vessels under inflammation, except that they appear broken down and partly dissolved in their texture instead of compact and of less regular figure; and, if when suspended in a drop of fluid, compared with the elastic blood-corpuscle, to which they bear no analogy whatever, utterly inert and devitalized. We never see pus in the blood-vessels but in fatal phlebitis, and, if introduced into the circulation by injection, it is destructive to life. Although, therefore, a clean-wiped granulating surface soon presents a covering of pus, it is exuded as a colourless fluid of a more dense and unctuous consistence than serum. Its appearance is simultaneous with the disappearance of the lymph-particle from the veins, the suppurative action being determined, or, in other words, the separation of the proper lymph-particle put an end to by its sufficient deposit in granulation, and the inflammatory nisus still prevailing from the continuance of the irritation, for no imperfect state can be perpetuated; the superabundant lymph-particle, at no time coloured, along with the permanent fluid or serum of the blood, is strained off through the pencils, forming the terminal loops of the granulation. Thus is obtained the twofold purpose of relief to the loaded capillary circulation, and a bland and homogeneous protecting fluid for the granulation during the period of its growth up to that of final organization. When the rudimental fibrin is no longer needed for the new structure, it is used, as in nature all remnants are, for a new but not less important purpose,—the preservation of that structure. Pus is as necessary to the maintenance of granulation as lymph was to its formation; but a change is necessary to fit it for its new function, and this is provided for by a new arrangement of a new action of the secreting capillaries, and a chemical change, which destroys its vital property and amalgamates the separated lymph-globules with the serum of the blood. The precedence of adhesive to suppurative action is sufficient to render presumable a necessary connexion between the lymph separated during the first process, and afterwards disappearing, and to explain the invariableness of this relation in the order of their appearance. There is no analogy between the effusions of serum or of *liquor sanguinis* incidental to primary wound or injury of any kind and pus, yet the ingredients of the two latter are the same: it is by the combinations of a vital chemistry that their appearance and sensible properties differ, and this we are capable of imitating. If this theory be admitted, it will explain the appearance of pus in the absence of the especial granular structure or distinct pyogenic membrane, as seen upon mucous, serous, and synovial surfaces and canals; and, even in the absence of fibrinous exudation, as in certain modes of inflammation, where the habit of the parts or the character of the inflammation renders them incapable of carrying on the adhesive action, or that action is by violence interrupted. Puriform mucus, muco-purulent secretion, are terms in common use, indicating the transition stage witnessed in these cases; so also the modifications of colour, consistence, and purity are explained, which are conveyed by the terms sanious, flaky, or whey-like, ichorous, &c., and the improvement of the secretion by elaboration from that of fistulæ and sinuses to the 'pus laudabile' of old authors concurrent with the improved vitality of the granulations, meaning a fuller proportion of the lymph-particle to the serum, and *vice versâ*, its degeneration in enfeebled and sinking states of the system. Thus also is explained the effect of inordinate and excessive suppuration to superinduce hectic, from the excessive withdrawment of that ingredient which forms the nutrient and restoring principle of the blood. * * * The conversion of the blood-corpuscle into the pus-corpuscle is a notion altogether gratuitous and unsupported either by appearance or probability; and, to my mind, the above is a theory more reconcilable with all the circumstances attending its origin than that which supposes *de novo* formation of the pus globules. But the wounds of cold-blooded animals not being subjected to the true suppurative process, nor those of mammalia and birds disposed to free suppuration, there appears to be insuperable difficulty in establishing this theory by actual demonstration." (pp. 172, 6.)]

14. The nature of the pus varies considerably according to the nature of the parts in which it is formed, according to the constitution of the person, according to the degree and character of the inflammation; it may be changed by other fluids, mingled with it. We distinguish good cream-like, uniformly consistent, yellowish white, inodorous pus, (*pus bonum et laudabile*, Lat.,) thin, mucous-like, serous, grayish, greenish, brownish, and more or less fetid pus (*sanies*, *ichor*, Lat.; *Jauche*, Germ.) (1). These varieties of pus, as well as the fluid products of inflammation especially, depend merely on the different proportions of the materials composing it. All these products are derived from the blood, and in them are found all the same materials as in the blood, excepting fibrin. Thus is it clear why chemical and microscopical examination cannot ascertain any determinate difference between the products of inflammation and the serum of the blood, the mucus, the serum from dropsy, the yellowish white fluid (*materia puriformis*) poured out from inflamed mucous membranes (2); the thin, lymph-like fluid which exudes from inflamed serous membranes (3) and the various kinds of pus appear to be compounded in the same way. Their difference consists only in the different proportions of the several substances, in their disposition to organization, and in the greater or less advanced degree of plastic activity (4).

The presence of globules in the serum has been long since proved by **Bauer** and **Faraday** (*a*), as also by **Mandt** and others in the various effusions and serosities which occur in the cellular tissue and in the serum of dropsy; but the albumen in pus is in

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(*a*) See **Home** on the Conversion of Pus into Granulations or New Flesh, in Phil. Trans. 1819, p. 2.

a higher degree of coagulation, is opake, of tolerable consistence, and coagulates less by warmth, and by the concentrated acids. The difference between creamy, consistent, and thin serous pus depends entirely on the different proportions of the fluid and of the pus-globules. **Bonnet**, (as above,) who seems not to know the pus-globules, derives this difference from the greater proportion of the emulsive fat in the former and its smaller proportion in the latter. We may give every kind of pus that semi-transparency, that stringy character, that adherence of its parts which seem especially proper to mucus, if we mix and shake it up with a solution of hydrochlorate of ammonia, whereby the proportion of one of its components is increased. The consistence of pus is to a certain extent influenced by the length of time it has been retained in the body, the absorption of its fluid part thereby occurring, and in suppurating surfaces perhaps also by the influence of the air, as, in the latter case, when the pus is washed off clean, a clear serous fluid is always observed to ooze up. In this manner we may judge of the various tests of pus, for the purpose of distinguishing it from mucus. According to **Grassmeyer** (*a*), if pus be mixed with twelve parts of distilled water and one part of *liquor potassæ*, a viscous transparent jelly capable of being drawn into thread is formed, more quickly or more slowly according to its different composition. According to **Gruithuisen**'s microscopic examinations (*b*), pus exhibits white spherical granules slightly dotted upon the surface, which after some hours fall, and even preserve their round form in pus which has been dried and again moistened. In mucus these granules only appear when it is previously thinned with pure fluid: the granules in mucus are less numerous and dark-coloured. **Fischer** (as above) holds it best, in order to determine the presence of pus and mucus, to mix and shake together the questionable matter with two or three parts of *liquor potassæ* or *liquor ammoniæ caustici*, and then to add hydrochlorate or nitric acid to neutralisation. If it contain pus, there will be produced by the continued addition of the acid a whitish flocculent sediment.

[(1) "Ichor," says **Gerber**, "has very various colours, and is generally more fluid than pus. The ulcer is a wound with a dead surface incapable of throwing out or organizing plastic lymph, bedewed with a depraved serum (*ichor*) destructive of every exudation. This ichor acts injuriously on the ulcer, destroying it and eating into the neighbouring vessels: hence the discharge of small quantities of blood, which is immediately discoloured in the ichor, and so much changed that the *liquor sanguinis* rarely coagulates, save in granules; the blood-corpuscles appear puffed up, corroded superficially, divided into irregular pieces or even shrivelled up. The blood-corpuscles thus altered are denominated *ichor-corpuscles*: they are commonly covered with granules attached to them or partially lying on them; their character is ascertained in the discharge of glanders which principally consists of them." (p. 56.)

(2) "Puriform mucus, secreted in the last stage of catarrhal affections, varies according to the extent of reproduction which the affected mucous membranes require. Should the mucous glands and follicles be altered in a less degree than the cuticle, which after catarrhs is always produced afresh, then the mucus, besides the usual mucous corpuscles and granules, contains, instead of the usual older elements of the epithelium, which are large, squamous, granulated, epithelial cells or cylinders, a large addition of newly-formed small lenticular cells, in which the nuclei are often recognised with difficulty; hence rendering them very like large exudation-corpuscles. Sometimes among these young epithelial cells true pus-corpuscles are observed, when any part of the mucous membrane needs reproduction." (p. 54.)

(3) "In serous exudations," he proceeds, "it is usual to find albuminous granules in albuminous fluids, and, if a great part of the serum be again removed by absorption, the crystals of different salts. * * * After plastic exudations, a yellowish turbid fluid is found in the affected cavities containing fine flocculi of a pale yellow colour: these are partially precipitated upon the walls of the cavity, which appear bestrewed over the whole extent of the exudation." (p. 42.)

The distinguishing characters of true Pus and Ichor have been already mentioned.

(4) This statement of our author, "that chemical and microscopical examination cannot ascertain any determinate difference between the products of inflammation and the serum of the blood," &c. &c., and that "their difference consists only in the different proportions of the several substances," &c. &c., is rather too hasty, as the extracts just quoted from **Gerber** on the subject show that there is a well-marked distinction among them.—J. F. S.]

15. Pus cannot be produced without inflammation; but the latter may

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(*a*) Abhandlung von dem Eiter und den Mitteln, ihn von allen, ihn ähnlichen Flüssigkeiten zu unterscheiden. Götting., 1790.

(*b*) Naturhistorische Untersuchungen über den Unterschied Zwischen Eiter und Schleim. München, 1809.

exist in so slight a degree as to be scarcely, or even not at all, observable, and, on account of the too slight vital activity of the organ, the low state of the nervous power, and of the plasticity of the blood and the diseased diathesis, a serous thin pus is produced without the appearances of inflammation being manifest. The circumscription also of the pus in a definite cavity proves that inflammation must have been present. Abscesses thus originating are called *Cold Abscesses, Lymph Abscesses* (*kalte Abscesse, Lymph Abscesse, Lymphgeschwülste*, Germ.; *Abcès froid*, Fr.) They are always the consequence of a general cacochemic or dyscracic affection, and arise either spontaneously and commonly in many places at once, or are produced by an external injury.

We may very properly apply with **Walther** the name *Diathesis purulenta* to that general condition of the body which is the ground of these abscesses; but it is improbable that pus can be formed in the blood itself by decomposition within the vessels, and that the blood can be immediately converted into pus. The circumstance of pus having been found in the blood, cannot form a ground for this opinion, as this, if the walls of the veins are not inflamed, intimates merely the absorption of the pus which has been found as well in the lymphatic vessels as in the veins (*a*). The so-called *abscess of congestion*, in which the source of the pus, mostly the carious destruction of bone, is more or less distant from the collection of pus upon the surface of the body, must be distinguished from cold abscess: this, however, will be considered in several places.

16. The commencement of cold abscess usually sets in, without any sensibly perceptible local appearance, with diminution of appetite, general uneasiness, slight fatigue, disturbed sleep, and so on. Next there appears on some part of the surface of the body, (where many patients fancy they have had a sort of prickly sensation,) most commonly between the shoulder-blades, on the chest, on the loins, on the upper part of the thighs, a little, not discoloured, elastic, scarcely fluctuating swelling, which is not painful, and at the utmost gives the patient an obscure sensation of tension and weight. Gradually the swelling enlarges, often to a considerable size, the fluctuation is distinct, and the symptoms of a disturbed assimilation become more marked. After a shorter or longer time, the swelling begins to be painful, the skin covering it reddens, becomes tense, the general appearances mentioned are more decided, febrile action sets in, and the whole countenance of the patient is cachectic. The skin, continuing to thin, at last breaks, and a quantity of thin, pus-like, often completely putrid and stinking, fluid is evacuated, followed by a clear discharge, which, if the neighbouring bone be destroyed, is of an ichorous character. By this great loss of the juices, and by the colliquative sweats and purging, which soon set in, the powers of the patient are speedily broken up.

[The cold abscess here described must be confounded neither with **Hunter's** "collections of matter without inflammation," (p. 390,) which are, as he says, of a scrofulous nature, and very different from that under consideration, nor with "the cold abscess of the surgeons of the Saracen school, the chronic abscess of modern surgeons," mentioned by **Boyer** and **Craigie** (*b*) (pp. 43—163), and caused by *chronic inflammation.*

The true cold abscess, which **Chelius** has here well described, is, I believe, very rare. I have recently had a case of which the following is a brief account:—

Philip Coyne, aged 26, admitted under my care,

August 27th, 1844. He was very irritable, complained of much lassitude and debility, and that he had some difficulty in passing his water, for which about a fortnight ago he had a catheter passed, but had not been since inconvenienced. He did not, upon examination, appear to have any surgical complaint; but, as he had been ill-fed, and suffering

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(*a*) See **Cruveilhier**, Anatomie Pathologique, vol. i. p. 200. **Gendrin**, as above, p 22.

(*b*) Elements of General and Pathological Anatomy. Edinburgh, 1828. 8vo.

privation for some little time before his admission, I kept him in the house for charity's sake, though I suspected he was feigning illness. He, however, grew worse, had a hot skin, with much perspiration, loss of appetite, pains in his joints; and, again complaining of difficulty in passing his water, which was not, however, caused by any stricture, I considered therefore his case to be medical, and, on

September 3rd. He was transferred to Dr. Burton's care, who treated him with sulphate of quinine and citrate of iron, with a colocynth and calomel pill occasionally. He continued growing worse, and, on

September 10th. I was requested to see him again, when he still complained of difficulty in voiding his urine, and had a largely diffused swelling extending over the whole right inguinal region, without redness, with little pain, but with distinct fluctuation, and extending down behind the right spermatic cord into the scrotum, which was so little protruded that the swelling there was only accidentally discovered. The swelling in the groin, which was only noticed yesterday or the day before, is quite subcutaneous. I made a puncture a little above the middle of Poupart's ligament, and drew off a pint of healthy, sweet-smelling pus, and the swelling in the purse subsided as it flowed. Half a grain of acetate of morphia nightly was ordered, to give him rest, which he much needed.

On the following day he was better, and a mutton chop with porter daily was ordered.

September 13th. There is little discharge from the puncture; but he now points to another subcutaneous abscess without redness and with little pain, beneath the spongy body of the penis, which was opened, and a table spoonful of good pus voided. He complains of much tenderness in the left knee, to which bran poultice was ordered.

September 14th. But little discharge from either opening. Since yesterday a large diffused swelling has presented on the left side of the chest, below the arm-pit, without redness, but tender and with indistinct fluctuation.

September 16th. The abscess just mentioned was opened, and four ounces of good pus discharged. He now points to another diffused swelling, without redness, on the front of the right shoulder, which fluctuates indistinctly. There is but little discharge from the groin. For the last two days he has been taking ammoniated citrate of iron, five grains, with a drachm of compound spirit of ammonia in infusion of quassia thrice a day. I ordered him, in addition, half a pint of port wine, as he sweats very profusely, has a quick, feeble pulse, and is very weak and thirsty.

September 17th. The abscess on the shoulder was punctured, and about an ounce of pus discharged. The sweating still continuing, he was ordered to take of dilute nitric acid ten drops in infusion of roses, thrice a day.

On the following day, being nauseated and a little sick, a draught of peppermint water with a drachm of sulphuric æther was ordered, but it did not do him much good, and, on

September 19th. He was ordered, instead, five minims of dilute hydrocyanic acid in water, a mustard poultice to the region of the stomach, and four ounces of brandy daily, instead of the wine. The abscesses on the shoulder and chest discharge freely; but those below are healed.

September 27th. On the whole, somewhat better; but the discharge is still very profuse. There is now much fluid in the mucous bag behind the insertion of the *m. rectus femoris*, and the knee is very tender: the bran poultice was discontinued, and a blister ordered, with a poultice afterwards.

October 8th. Has not materially improved, and is now attacked with diarrhœa. Ordered fifteen minims of nitro-muriatic acid three times a day.

October 9th. The diarrhœa continues, and is now accompanied with sickness. The acid to be left off, and in its stead fifteen grains of carbonate of potass, with compound tragacanth and acacian gum powder in clove water, with compound spirits of ammonia and tincture of cardamoms, every four hours.

October 21st. On the whole, better; but little discharge from the abscesses; the knee unimproved.

October 28th. Another blister applied to the knee.

November 2nd. The knee considerably swollen and painful; an issue to be put in above and below the joint.

Having got into a very awkward and uneasy posture, his left leg being laid completely on the outside, and not moveable without great pain, I thought it advisable to get the limb on an amesburg, and gradually from day to day to raise it up till on the heel. This was effected in the course of a few days, and rendered him much more comfortable, and the knee diminished in size, as the issues began to discharge. He never, however, rallied, but gradually continued drooping, became very excitable and so weak that he continually passed his motions beneath him. A patient's death near him had very much troubled him during his illness, and, another having died on 22nd December, he again became alarmed, and sunk on the following morning without any other especial cause.

The examination of the body on the third day after death presented the following remarkable and unexpected appearances, as he had never made any complaint, nor had the attendants more than myself noticed any circumstance which could lead to the expectation of the results which occurred.

The body generally was thin, but not much emaciated. The slough on the rump had exposed a large portion of the sacrum. Between the crest of the right ilium and the great trochanter, the soft parts were prominent and fluctuating.

The heart and lungs were perfectly healthy.

All the abdominal viscera were healthy except the liver, which was much enlarged, and extremely pallid, and had degenerated into fat to an extreme degree.

The right *m. iliacus* was raised from the concavity of the ilium; prominent, tense, fluctuating when touched, and the fluctuation communicated to the external prominence between the iliac crest and trochanter. When the muscle was cut into, a large quantity of dirty stinking pus was found filling the iliac pit internally, and communicating through the ischiatic notch, of which the edge had become carious and rough, with a quantity of similar pus extravasated among the gluteal and all the muscles in the neighbourhood of the back of the hip-joint. All the muscles were separated from each other, and had assumed a greenish appearance. In front of the joint there was only a small collection of pus, and the muscles were seemingly healthy. The hip-joint contained a small quantity of dirty purulent fluid; there were slight traces generally of synovial inflammation, specially at the notch, and where the acetabulum was devoid of cartilage. The right ilium was rough and carious on both external and internal surface, and the right sacro-iliac symphysis so extensively destroyed that slight force separated the bones, the surfaces of which were carious.

The left knee-joint: nearly all the articular surfaces deprived of their cartilage, small isolated patches alone remaining, and the exposed surface of the bone being everywhere rough and carious. The crucial ligaments were only partially destroyed.

Neither of the vertebral bodies were affected with disease.—J. F. S.

My friend Dr. Rigby (*a*), in his account of contagious or adynamic puerperal fever, speaks of a peculiar kind of abscess following attacks of that disease, which we saw together in several instances at the General Lying-in Hospital. "Where," says he, "the constitution has borne the brunt of the attack without immediate collapse, and the local mischief been controlled by appropriate means, we find that fresh efforts are made to rid the circulation of the morbid matter with which it is infected. The patient is suddenly seized with severe pain, with heat, redness, and swelling of one of the large joints, presenting all the appearance of arthritic or rheumatic inflammation, and also of certain muscles especially, the supinatores of the arm, the glutæi and gastroenemic. The painful spot soon becomes hard, it is intensely tender, and in two or three days the feeling of fluctuation indicates the formation of an abscess, from which a large quantity of greenish coloured pus mixed with blood and serum, is discharged. The cellular tissue beneath the skin and between the muscles is equally affected, and, if examined when the abscess is just beginning to form, will be found of a dirty brown colour, softened, infiltrated, and here and there condensed with lymph or pus, precisely as in cases of gangrenous erysipelas: the muscular tissue has entirely lost its red colour, and closely resembles the appearance of boiled meat, its structure so softened as to tear easily under the fingers, and interspersed with deposits of immature lymph and purulent fluid, the commencement of what would have been an abscess. Like gangrenous erysipelas, the extent of the abscess does not seem to be limited by a surrounding wall of healthy lymph, as seen in a common phlegmon, but, if deep beneath the surface, it continues to spread in all directions, until nearly the whole limb appears to be implicated in one immense abscess: hence, in those patients who have recovered under these attacks, the limb has frequently been rendered useless, the muscles being atrophied and coherent." (p. 291.) The following observation of the same writer in reference to the contagious nature of these abscesses is extremely important. "That the discharges from a patient under puerperal fever are in the highest degree contagious, we have abundant evidence in the history of lying-in hospitals. The puerperal abscesses are also contagious, and may be communicated to healthy lying-in women, by washing with the same sponge; this fact has been repeatedly proved at the Vienna hospital; but they are equally communicable to women *not pregnant:* on more than one occasion the women engaged in washing the soiled bed linen of the General Lying-in Hospital, have been attacked with abscesses in the fingers or hands, attended with rapidly spreading inflammation of the cellular tissue." (p. 292.)]

(*a*) A System of Midwifery, Lond., 1844, forming part of Tweedie's Library of Medicine.

17. **Beinl**, **Rust**, and others, consider the nature of the so-called lymph-swelling to be an *extravasation of lymph*, depending on a rupture of the lymph-vessels, or on an unnatural extension of their walls, and they explain the gradual sinking of the powers of the constitution and so on, which occur at the latter period of the disease, and after its bursting, by the continued loss of the lymph (*a*). The observations made on the fluid contained in these swellings (which **Rust** imagined to be only in the earlier period of the disease, transparent and colourless) have shewn that it has more of the properties of pus than of actual lymph, and **Walther** has decidedly proved that the acceptation of the term lymph-swellings in the sense just mentioned is inadmissible; that they must be considered only as abscesses (*lymph-abscesses*) preceded by a stealthy, if not a sensibly perceptible, inflammatory condition, which, however, on account of the too much depressed vital activity, could not produce a plastic consistent pus, but only a secretion of a thin more or less turbid lymphatic fluid. The opinion advanced by **Beinl** that the strongest and most healthy subjects are commonly more subject to this disease than the weakly, that men more than females, and that, without an external injury, a general diseased condition is incapable of producing a lymph-abscess, is incorrect, and has been disproved by **Rust**. How frequently, even by writers on lymph-swellings, cold abscesses and such collections of pus as have formed at distant parts (*congestion-abscess*) (*b*), in consequence of carious destruction of the bones of the vertebral column, have been taken for lymph-swellings, and treated as such, I myself have frequently observed.

Nasse (*c*) describes a case in which a powerful healthy young man, in consequence of an external injury, had a swelling formed on the upper part of the thigh, the contents of which, after opening, perfectly resembled lymph. The pouring out of a clean transparent fluid could not be allayed by any treatment recommended for lymph-swellings, and the patient was exposed to the danger of hectic consumption. The local use of a solution of nitrate of mercury alone brought the lymph-vessels to close. This case (which I myself saw, although only once, in passing through Halle, and convinced myself of the continued outflowing of clear lymph which could be increased by pressure) proves that a collection of lymph in the cellular tissue is possible, as the consequence of an actual tearing of lymph-vessels by external violence, the exudation from which ceases only by obliteration of the torn vessels. Cases of this kind are, however, undoubtedly very rare; to them alone can be applied the term *lymph-swelling* in its proper sense, and therefore the above advanced opinion, "*that the cases commonly spoken of as lymph-swellings are merely modifications of abscesses,*" is rather confirmed than contradicted. This opinion **Langenbeck** (*d*) has also advanced; although he adds, that not unfrequently a swelling is observed on the elbow, which is formed sometimes from a local cause, and sometimes also without, is situated immediately on the olechranon, and contains a clear lymphatic fluid enclosed in a cyst, which deserves the name of lymph-swelling, I must yet deny this assertion, as this swelling at the elbow joint is a dropsy of the mucous bag there situate, and may be compared to the *Hygroma cysticum patellare*. Just as little also can I agree with the opinion of **Ekl** (*e*), who considers the lymph-swelling as an expanded mucous bag in which there is a diseased secretion going on. **Zembsch** (*f*), according to **Kluge**, in order to accommodate the different opinions of writers, distinguishes, 1st, the acute and chronic lymph-swelling, as idiopathic and symptomatic disease; 2nd, the false lymph-swelling or lymphatic abscess.

[A case marked in my note-book, "Collection of synovial fluid within the femoral sheath," which occurred in St. Thomas's Hospital in 1839, seems to me more nearly allied

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(*a*) J. A. **Schmidt**, über den Grund der Todtlichkeit de Lymphgeschwülste; in Abhandlungen der Medic. Chirurg. Jos. Akademie in Wien, vol. ii.

(*b*) A. **Pauli**, Bemerkungen über Congestions abscesse; in **Rust's** Magazin, vol. vii. p. 383, vol. viii. p. 434.

(*c*) Archiv für medicinische Erfahrung von **Horn**, **Nasse**, und **Henke**, vol. i. 1817, p. 377.

(*d*) As above, vol. ii. p. 197.

(*e*) Bericht über die Ergebnisse; in Chirurg. Klinikum zu Landshut. Landshut, 1824. 4to.

(*f*) Ueber du Lymphgeschwülst; in **Rust's** Magazin, vol. xxvii. p. 1.

to the lymph-abscess of this paragraph, of which I was then ignorant than to a collection of synovia, as I thought it perhaps might be. The patient was a healthy country lad, seventeen years old, who three years previously had received a blow on the upper outer part of his left thigh, but seemed to have recovered from its effects. Two months since he noticed a swelling on the outside of the same thigh, about a hand's breadth above the knee-cap, which gradually increased both downwards and upwards, so that at his admission it occupied the outer and fore part of the thigh, from a little above the knee to near the great trochanter, fluctuated distinctly, and was presumed to be an abscess in the outer chamber of the femoral sheath. Fifteen minims of tincture of muriate of iron in mucilage thrice a day were ordered, to excite absorption, which was continued for nearly three weeks without benefit. The thigh then having increased, and fluctuation and swelling having extended about the whole knee, I made, by the direction of my then colleague TRAVERS, whose patient he was, an incision two inches long, about the middle of the outside of the thigh, expecting to evacuate pus or open the femoral sheath; but neither pus nor any other fluid escaped, although I cut into the *m. vastus externus* an inch deep. A tent of lint was left in the wound to keep it open, and hasten the escape of pus if any should make its way through the wound; but none appeared, and in the course of a fortnight the wound had entirely healed. The tincture of iron, which had been continued to this time, was now left off, and two grains of iodide of iron thrice a day, ordered in its stead. A week after the whole thigh was wrapped in mercurial ointment, and swathed in a roller. This treatment was continued for three weeks, but without any diminution in size, or apparent change; fluctuation was still very distinct, and the fingers of one hand being applied, whilst pressure was made with the other hand alternately above, a thrilling fluctuation was felt. It was therefore determined to introduce a grooved needle about the middle of the thigh, and some fluid very similar to synovia escaping by it, an abscess lancet was then, with my colleague's consent, thrust in, making an opening an inch long in the skin, and half its length in the sheath, from which escaped about twenty ounces of the seemingly synovial fluid, which nearly emptied the cavity, leaving a rather moveable lump about the middle of the fore part of the thigh, the character of which I could not make out. The edges of the wound were carefully brought together, the limb rolled, and in four days union had taken place. A week after another free puncture below the former voided a quart of the same fluid as before, and on applying heat it coagulated speedily and almost entirely. The wound was left open, and a roller applied above and below it; but in the course of a week it had again united, and fluid was again secreted, though in smaller quantity. A solid but moveable swelling had at this time also formed to some extent around the wounds. The iodide of iron was then omitted, and, instead, was ordered decoction of sarsaparilla four ounces, with five grains of iodide of potash twice a day; the whole thigh to be enveloped in ointment of iodide of potash. Three weeks after the solidification had increased, and the fluctuation generally was less distinct, and soon after the ointment was given up, and mercurial plaster applied. Two months after, having begun to take the iodide of potash, the thigh had much diminished, there was less fluctuation, the middle outer skin was almost solid, and there is less effusion about the knee. The diminution of size and fluctuation continued, and in about two months he was able to walk about. He continued with us about four months longer, and, when he left the house, the swelling about his knee, although not completely subsided, had so considerably diminished as not to interfere with his walking.—J. F. S.]

18. Ulceration (*Exulceratio*, Lat.; *Verschwärung*, Germ.; *Ulcération*, Fr.) is distinguished from suppuration, in being connected with an actual destruction of parts, (by ulcerative absorption,) and with the secretion of a thin, acrid, fetid, and variously coloured pus-like fluid. It arises either immediately from inflammation, or from a preceding abscess. Its causes are either local injury,—for instance, improper treatment of the abscess which has been opened,—or general disease, as scrofula, syphilis, and so on.

[In considering the subject of ulceration, or "ulcerative inflammation," as he most properly calls it, HUNTER first indicates the economy of the absorbent vessels, and speaks of them in two views: first, as they absorb matter, which is not any part of the machine; secondly, as they absorb the machine itself." The former of these functions is of two kinds, of which the one absorbs external matter, either applied to the skin or received into the alimentary canal; and the other takes up internal matter, as many of the secreted juices, the fat and the earth of bones, &c.; both, however, serve principally to the nourishment of the body as well as to other and even hurtful purposes. The second function, that of "removing parts of the body itself, * * * may be viewed in two lights." The one view presents them as causing "a wasting of the whole machine or part, * * * which I call *interstitial* absorption, because it is removing parts of the body out of the interstices of that part which remains, leaving the part still as a perfect whole. But this mode is often carried further than simply wasting of the part; it is often continued till not a vestige is left, such as the total decay of a testicle." The other view exhibits them as "removing whole parts of the body," and "may be divided into the natural and diseased." Under natural circumstances the absorbents "are to be considered as the modellers of the original construction of the body;" for "no alteration can take place in the original formation of many of the parts, either in the natural growth, or that formation arising from disease, in which the absorbents are not in action, and take not a considerable part: this absorption I shall call *modelling absorption.* * * * Absorption, in consequence of disease, is the power of removing complete parts of the body, and is in its operation somewhat similar to the first of this division or modelling process, but very different in the intention, and therefore in its ultimate effects. This process of removing whole parts in consequence of disease, in some cases, produces effects which are not similar to one another; one of these is a sore or ulcer, and I therefore call it (the absorption) *ulcerative.* In other cases no ulcer is produced, although whole parts are removed; and for this I have not been able to find a term; but both may be denominated *progressive* absorption. * * * * * It may be difficult at first to conceive how a part of the body can be removed by itself; but it is just as difficult to conceive how a body can form itself, which we see daily taking place; * * * but this I may assert, that wherever any solid part of our bodies undergoes a diminution, or is broken in upon, in consequence of any disease, it is the absorbing system which does it. When it becomes necessary that some whole living part should be removed, it is evident that nature, in order to effect this, must not only confer a new activity on the absorbents, but must throw the part to be absorbed into such a state as to yield to this operation. This is the only animal power capable of producing such effects, and, like all other operations of the machine, arises from a stimulus or an irritation; all other methods of destruction being either mechanical or chemical. The first by cutting instruments, as knives, saws, &c.; the second by caustics, metallic salts, &c. The process of ulceration is of the same general nature in all cases; but some of the causes and effects are very different from one another." (pp. 440, 2.) "This process of the removal of parts of the body, either by interstitial or progressive absorption, answers very material purposes in the machine, without which many local diseases could not be removed, and which, if allowed to remain, would destroy the person. It may be called in such cases the natural surgeon. It is by the progressive absorption that matter or pus, and extraneous bodies of all kinds, whether in consequence of or producing inflammation and suppuration, are brought to the external surface; it is by means of this that bones exfoliate; it is this operation which separates sloughs; it is the absorbents which are removing old bones, while the arteries are supplying new ones; and, although in these last cases of bones it arises from disease, yet it is somewhat similar to the modelling process of the system in the natural formation of bone; it is this operation that removes useless parts, as the alveolar processes when the teeth drop out, or when they are removed by art; as also the fangs of the shedding teeth, which allows them to drop off; and it is by these means ulcers are formed. It becomes a substitute in many cases for mortification, which is another mode for the loss of substance; and in such cases it seems to owe its taking place of mortification to a degree of strength or vigour superior to that where mortification takes place; for, although it arises often from weakness, yet it is an action, while mortification is the loss of all action. In many cases it finishes what mortification had begun, by separating the mortified part. These two modes of absorption—the interstitial and the progressive—are often wisely united, or perform their purposes often in the same part which is to be removed; and this may be called the *mixed,* which I believe takes place in most cases, as in that of extraneous bodies of all kinds coming to the skin; also in abscesses, when in soft parts. It is the second kind of interstitial absorption, the progressive and the mixed, that become mostly the object of surgery, although the first of the interstitial sometimes takes place so as to be worthy of attention. This operation of the absorption of whole parts, like many other processes in the animal economy, arising from disease, would often appear to be doing mischief, by destroying parts which are of service, and where no visible good appears to arise from it: * * * but in all cases it must still be referred to some necessary purpose; for, we may depend upon it that those parts have not the power of maintaining their ground, and it becomes a substitute for mortification; and, indeed, in many ulcers we shall see both ulceration and mortification going on; ulceration removing those parts that have power to resist death." (pp. 444, 5.)

As regards "the absorption of whole parts from disease, it would appear," says HUNTER, "that they are capable of being absorbed, from five causes: first, from parts being pressed; secondly, from parts being considerably irritated by irritating substances; thirdly, from parts being weakened; fourthly, from parts being rendered useless; fifthly, from parts becoming dead." (p. 446.)

"The dispositions of the two parts of the living body, which absorb and are absorbed, must," says HUNTER, "be of two kinds respecting the parts; one passive and the other active. The first of these is an irritated state of the part to be absorbed, which renders it unfit to remain under such circumstances; the action excited by this irritation being incompatible with the natural actions and the existence of the parts, whatever these are, therefore become ready for removal, or yield to it with ease. The second is, the absorbents being stimulated to action by such a state of parts, so that both conspire to the same end. When the part to be absorbed is a dead part, as nourishment or extraneous matter of all kinds, then the whole disposition is in the absorbents. (p. 446.) Many parts of our solids are more susceptible of being absorbed, especially by ulceration, than others, even under the same or similar circumstances, while the same part shall vary its susceptibility according to circumstances." (p. 447.)

"Progressive absorption is divisible into two kinds, one without suppuration, and the other with. * * The absorption which does not produce suppuration may take place, either from pressure made by sound parts upon diseased parts, or by diseased upon sound parts." (p. 454.) The absorption attended with suppuration, "which I call *ulceration*," * * * is connected with the formation of pus, being either a consequence of it or producing it, and is that which in all cases constitutes an ulcer. It is this which principally constitutes the progressive absorption. This differs from the foregoing in some circumstances of its operations. It either takes place in consequence of suppuration already begun, and then the pus acts as an extraneous body, capable of producing pressure; or absorption attacks external surfaces from particular irritations or weakness, in which case suppuration, forming an ulcer, must follow, let the cause of that breach or loss of substance be what it may." (p. 456.)

"This process of ulceration or absorption with suppuration, is almost constantly attended by inflammation, but it cannot be called an original inflammation but a consequent, which gave rise to the term 'ulcerative inflammation.' It is always preceded by the adhesive inflammation, and perhaps it is simply this inflammation which attends it." (p. 457.)

"The effect, then, of irritation, as above described, is to produce first the adhesive inflammation in such parts as will readily admit of it, and, if that has not the intended effect, the suppurative takes place, and then the ulceration comes on to lead the matter already formed to the skin if it is confined." (p. 458.) "Any irritation which is so great as to destroy suddenly the natural operations of any one part, and the effect of which is so long continued as to oblige the parts to act for their own relief, produces in some parts, first, the adhesive inflammation; and, if the cause be increased or continue still longer, the suppurative state takes place, and all the other consequences, as ulceration; or, if in the other parts, as secreting surfaces, then the suppurative takes place immediately, and, if too violent, the adhesive will succeed; or, if parts are very much weakened, the ulcerative will immediately succeed the adhesive, and then suppuration will be the consequence. This species of ulceration in general gives considerable pain, which pain is commonly distinguished by the name of soreness; * * * but it does not attend all ulcerations, for there are some of a specific kind, which give little or no pain, such as the scrofula; but, even in this disease, when the ulceration proceeds pretty fast, it gives often considerable pain: therefore the pain may in some degree be proportioned to the quickness of its operation. The greatest pain which in general attends this operation arises from those ulcerations which are formed for the purpose of bringing the matter of an abscess to the skin, as also where ulceration begins upon a surface, or is increasing a sore: whether the increase of pain arises from the ulcerative inflammation singly, or from the adhesive and ulcerative going on together in the same point, is not easily determined; but, in some cases, these three are pretty rapid in their progress, and it is more than probable that the pain arises from all these causes. In those cases where ulceration is employed in separating a dead part, such as sloughing, exfoliation, &c., it is seldom attended with pain: perhaps it may not be easy to assign a cause for this." (p. 459.)

The following are some of Travers's observations on this important subject:—"Ulceration, when it occurs, is consecutive to adhesion and suppuration, in almost all cases; and, although suppuration may now and then pass without ulcerations, in the same manner as adhesion prevents suppuration, yet the frequent case of ulcerative inflammation succeeding to abscess, and the very rare existence of ulceration without pus, constitute the ulcerative, third in order, of the processes of inflammation." (p. 187.)

"Ulcerative absorption never occurs but as an inflammatory process, and the action of the absorbents in this process is therefore exclusively a morbid one, and generally partakes of an increase proportionate and corresponding to the opposed action of morbid secretion." (p. 188.)

"The ulcerative, being a purely vital action of the absorbents proper to the part affected, goes on progressively, either by perforation of the substance, or by an encroachment on the surface, or by undermining and separating parts prepared by disorganization or actual death for being cast off. The texture of the part determines which of these modes of action is employed. The cornea, the cartilage, and bone present the penetrating and circumscribed, foveolous or fossulated ulcer, a pit or chink; the cellular membrane presents the hollowing and undermining process, as in the sinuses and pouches of abscess in cellulous parts and on the margin of indolent ulcers, also between the articular extremities of bones and their cartilages; the spreading or superficial ulceration is best exemplified in the skin. But it is always by the absorbents proper to the inflamed surface that this action is carried on." (p. 190.)

"The ulcerative process stands between the life and death of parts subjected to its action, and administers to either, according to the circumstances of the case; being the instrument of reparation in the suppurative and adhesive inflammation, and of separation and removal of the waste and decayed, in the suppurative and gangrenous. It is the agent of granulation in the former, of sloughing in the latter, case, suppuration being the common link by which these extreme processes are connected. Without granulation ulceration is a wasting process; with it, a repairing one. In like manner, ulceration without suppuration is a devastation without means of control or repair." (pp. 191, 2.)

"An ulcer is a patent and familiar illustration of the pathology, not only of the ulcerative, but of all the processes of inflammation; and, as it is that vital action by which not only the dead are separated from the living, but the living are removed, which have undergone such organic changes, or lost so much of their vital power as to be incapable of resisting absorption, it may be regarded, as before observed, as an agent for life and death, and, if in one case the 'natural surgeon,' (Hunter,) in another the natural destroyer." (p. 196.)]

19. Hardening (*Induratio*, Lat.; *Verhärtung*, Germ.; *Induration*, Fr.) occurs when during inflammation the fluids effused into the cellular tissue (*par.* 4) collect, thicken, and connect the walls of the cells together. Vessels pass into the connecting mass, which becomes organized, and the nutrition of the swelling depends on these vessels. If they are numerous or much expanded, the volume of the part is correspondingly increased, and permanent coagulable lymph is deposited, fatty or even bony masses are produced. If the walls of the cells become firmly united together without further deposit in the swelling, the hardened part sometimes becomes smaller than in the healthy state. The hardness of the indurated part varies according to the quantity of lymph effused in the cellular tissue, according to the structure of the part, according to the course of the previous inflammation, and the duration of the hardening. The skin upon the swelling is commonly not changed: the vessels, however, may be varicose, or the skin itself may be intimately united with the swelling. In this manner are formed, consequent on inflammation, various degenerations, enlargement of parts by hypertrophy, sarcomatous, steatomatous degenerations, and so on.

20. In the hardened parts, if no peculiar irritation exist, the sensibility is

lessened, the circulation seems to proceed but imperfectly, because the nerves are completely enveloped in the plastic mass which connects the several parts, and the more minute vessels are closed: hence the temperature is lower, often sensibly so to the patient himself. Sometimes not the least inconvenience arises from the hardening; but it may run into inflammation, ulceration, and cancer (*a*).

In every part inflammation may run into hardening; but especially in long-continued insidious inflammations; in organs which possess a low degree of vitality, in glands, and those organs in which the very numerous ramifications of vessels are surrounded with dense cellular tissue, in persons of atrabiliary constitution, who have had much mental anxiety, have been subject to scrofula or other diseases which depend upon unnatural mingling of the juices.

21. The transition of Inflammation into *Softening* (*Erweichung*, Germ.) produces changes directly contrary to those caused by hardening, viz., diminished cohesion and consistence—liquescence. It occurs only in long continued dyscratic and cachectic inflammations; it is always connected at the onset with collections of serous, not plastic, matter in the parenchyma of the part, which is therefore sometimes loosened up and thickened; or it consists in actual deliquescence and dissolution of the parts, probably consequent on diminished or changed nervous influence. It may, to a certain extent, be considered as the intermediate condition between ulceration and mortification. The softer and looser the texture of an organ, so much the more readily does softening take place, though it also occurs in hard organs; for example, in the bones: childhood is most subject to it. In many swellings softening precedes and accompanies their giving way.

22. *Mortification* (*Gangræna*, *Sphacelus*, Lat.; *Brand*, Germ.; *Gangrène*, *Sphacèle*, Fr.) is the passage of inflammation into partial death, and the mortified part is subject to the general chemical laws. We usually distinguish with the name of mortification two conditions, viz., the *hot Mortification*, (*Gangræna*, *heissen Brand*, Germ.; *Gangrène chaude* ou *Asphyxie des parties*, Fr.,) in which the living power is not perfectly extinguished, and in which it may be restored to its natural action, (here there is but a certain degree of inflammation,) and the *cold Mortification*, (*Sphacelus*, *kalten Brand*, Germ.; *Gangrène froide*, ou *Sphacèle*, Fr.,) in which the part is actually dead.

[The division here employed by CHELIUS is that proposed by Dr. JOHN THOMSON. TRAVERS objects to the terms mortification and sphacelus on the following ground:—"I do not," says he, "employ the term 'mortification' because it is not technically explicit, and has been vaguely and indiscriminately used. Nor shall I use the term 'sphacelus,' because gangrene is a sufficient synonyme, if the term gangrenous inflammation be accepted, which presents the stages of recoverable and irrecoverable, threatened and devitalized texture. A gangrened part is never restored. By the arrest of gangrenous inflammation, the gangrene may be circumscribed, and, by the supervention of other processes, the dead may be cast off, and the living part repaired with more or less loss of substance. The special use of the term sphacelus has been to designate a state of utter death, in which the part becomes subject to chemical changes, as if severed from the body, and such meaning I affix to the substantive term 'gangrene.'" (p. 208.) Hence it will be observed that TRAVERS's gangrenous inflammation, and his gangrene, are synonymous with CHELIUS's hot mortification, and with his cold mortification.—J. F. S.]

23. Mortification truly consists in the extinction of vascular and nervous activity, in consequence of which partial death ensues. This transition

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(*a*) WENZEL, Ueber die Induration und das Geschwür in indurirten Theilen. 8vo. Mainz, 1815.

is to be feared in unusually severe and quickly developed inflammations with well marked general symptoms in young powerful subjects, and after the operation of severe injuries; in persons with the general appearance of weakness, if the redness of the inflamed part be bluish, of a dirty yellow, the pain slight, and if it be accompanied with typhus. If the pain quickly increase to a great degree, the inflammatory swelling be hard, dry, and very tense, the heat intolerable, the skin dark red, often brownish, the fever extraordinarily severe, and no appearances ensue which lead to the hope of the inflammation terminating in suppuration, then the signs of incipient exhaustion become manifest. The acute pain becomes dull, aching, stretching; there is still indeed circulation, but its current gets slower and slower, and at last stops altogether. The redness therefore becomes deeper, more dusky, and further extended; the warmth diminishes, the swelling, at first hard and tense, becomes soft, doughy, œdematous, the cuticle rises in blisters, containing a dark-coloured brownish fluid. In this condition the part has not yet lost all its sensibility and warmth; the vital activity may therefore be reawakened and reparation effected. The pulse is small, quick, and loses all fulness and hardness; the patient is depressed, is uneasy, has a languid countenance, cold sweats, dry, dirty tongue, unquenchable thirst, frequently burning hot skin; the features at the same time become pinched, and the urine is thick. When exhaustion of the living activity and fully developed mortification takes place, then the pain ceases entirely, the colour of the part becomes blue, ash gray, or even black, the bone assumes a light white, dirty yellowish, or even black spotted appearance. By the decomposition of the parts still covered with skin, and the evolution of the gases of mortification an emphysematous swelling is produced, the part becomes quite cold, and the general appearances of exhaustion are present in a higher degree, the mortification either spreads further, and death ensues from exhaustion, or on the confines of the slough is produced a bright redness, suppuration, and by the operation of the absorbing vessels a groove, becoming deeper and deeper, by which the slough is thrown off.

[This is Travers's acute gangrene. He observes also, that "if the inflammation occupies a circumscribed space, it is generally consecutive upon, and defined by, the adhesive inflammation; if it appears in several contiguous spots or patches, the whole of the intervening surface, and more or less of the subjacent and surrounding part, partakes of the inflammation and is marked for destruction; if, as often happens, it is of irregular size and shape and the surrounding margin darkly discoloured, tumid and painful to the touch, it is spreading, and rapidly travels along a continuous surface without check, to the destruction of texture, and generally of life. * * * In some rare instances, gangrenous inflammation takes possession of an entire structure, as, for example, hand or foot, or even a limb up to its connexion with the trunk, and beyond it, and the indication is the sudden subsidence of agonizing pain, change of colour to a pale bluish hue, loss of temperature and of sensation, so that the limb looks and feels like gray or clouded marble. I have seen in two cases the upper and lower extremities of the same side so affected in the same patient. The rapid dissolution of the vital principle in such instances, anticipates the march of disorganization; such cases are generally depending on nervous prostration from injury or operation, attended by peculiar circumstances of aggravation, or, yet more frequently, peculiar temperament." (pp. 209, 10.)]

24. The decomposition of the mortified part is accompanied by a peculiar exhalation, different in smell from that occurring in the decomposition of dead bodies, the cause of which seems to depend on the higher temperature to which the mortified part is exposed. The destruction of the mortified part occurs in different ways: 1st, the slough shrivels up, the

cuticle does not separate, the fetid exhalation is less, the pain is sometimes very severe (*Dry Gangrene; Trockner Brand*, Germ.; *Gangrène sèche*, Fr.;) 2nd, the mortified part increases in bulk, the cuticle rises in blisters, which burst and discharge a quantity of stinking ichorous fluid (*Moist Gangrene; Feuchter Brand*, Germ.; *Gangrène humide*, Fr.;) 3rd, all the organic structures without distinction are changed into a glutinous grayish white or ulcerous mass (*Hospital Gangrene; Hospitalbrand*, Germ.; *Pourriture d'hôpital*, Fr.)

[In severe bruises, and occasionally when, after the swelling of a limb consequent on a fracture, the bandages confining splints have become tight and caused much pressure, vesications filled with bluish or bluish-black fluid occur. This often excites alarm, and is mistaken for mortification; but it is of little consequence. It is only requisite to puncture the blisters with a needle, evacuate the fluid, and apply lead wash for a few days, when all soon becomes sound. If the vesications are left unemptied, they often produce inconvenient superficial sores, which heal with the use of zinc ointment.—J. F. S.]

25. Mortification may be produced by all hurts which cause a too high degree of inflammation, obstruction of the circulation, weakness, oppression of the nervous activity, and thereby loss of life of a part; for instance, too irritating treatment of inflammation, checking of the circulation by ligature, too tight bandaging, pressure kept up by unyielding aponeuroses; violent operation of heat and cold, malignant character of the inflammation where in seeming mildness of the symptoms mortification often occurs, of which the cause is generally unknown, but sometimes depends on hurtful matter in the bowels; further, from a great degree of weakness, degeneration of the juices, scurvy, and so on, malignant, putrid fevers, great age, severe bruises and concussions, by which the part is filled with stagnant juices; ligature and ossification of the vessels, (which may without inflammation give rise to mortification,) certain fluids extravasated from their cavities, as urine, bile, feculent matter; bad foul air and contagious influences.

[Brodie (*a*) enumerates sudden loss of blood as sometimes causing mortification, and in proof mentions the case of a man who, whilst very tipsy, one evening, was bled to the extent of three pints, when he became very ill, and the next morning his toes and feet up to the insteps were mortified. They sloughed off, however, and he did well. (p. 635.)

Travers mentions among the causes of mortification "such deep and extensive effusions as compress and annihilate the internal circulation of the part. Thus, I have seen," says he, "a subfascial effusion, following a severe strain of the fore arm, producing a spreading gangrenous inflammation of the extremity to within a hand's breadth of the axilla; and similar cases, of suppuration, between the deep-seated muscles of the thigh, I have known terminate suddenly in gangrenous inflammation of the entire limb to the groin. Injuries of nerves, particularly, are liable to be followed by gangrenous inflammation: of this I have also seen some marked examples. Baron Larrey found reason to attribute the gangrene of the foot following the operation for popliteal aneurism to the nerve having been injured or included in the ligature." (p. 214.)

I recollect many years ago seeing a case of mortification of the whole lower extremity, consequent on a bayonet wound of the femoral artery, in which the death of the limb seemed to result from the slow effusion of blood and gradual distension first of the fasciæ, and subsequently of the skin, which occupied many months. The man was a sailor, and during a homeward voyage from the East Indies dropped a bayonet point into his thigh. The ship being without any surgeon, the captain bandaged the thigh tightly up, and effectually prevented external hæmorrhage for five or six weeks. When he reached home, he was brought to St. Thomas's Hospital, and, on removing the bandage, the wound was found united. The limb was much swollen up to the pelvis;

(*a*) Lectures on Mortification; in London Medical Gazette, 1840–41, vol. i.

but his health had not suffered much. It was thought advisable to wait and see what might be the result. The limb increased in size, the skin gradually became more and more discoloured, and gangrenous in patches; indistinct fluctuation was perceived: he was slowly worn out, and died. On examination, the whole limb was found distended with blood, some of which was coagulated, some fluid, and other mixed with pus. On removing the clots, which were principally about the femoral artery, a spurious aneurism was found, the sac formed by the clot being as large as a hen's egg around the wound made by the bayonet in the artery, which had not closed, and was rather bigger than a crow-quill. On one side of the sac, close to the vessel, was a small aperture, by which blood had continued escaping, probably up to his death, into the surrounding soft parts.

Mortification of a limb, or at least of that part of it in the neighbourhood of an aneurismal sac (which is not uncommon if from any cause the vessel have not been tied at the proper time) in general depends simply on the distension from effusion, which at last bursts the skin.

Mortification occasionally happens in simple fracture, from slow but continued effusion, and without wound of the principal artery or arteries of the limb. I have seen this once in a flour-porter, whose leg was broken by being jammed with a cart-wheel; his constitution speedily took the alarm, and, though incisions were made through the skin to relieve the tension, he gradually became worse, and sunk into hectic, in which state his limb was removed; but he died a few hours after. Although from the first no pulsation could be felt in the tibial arteries, yet the examination after death showed them uninjured and undiminished in size.

Mortification I have also seen in one or two instances occurring from splints having been applied previous to the subsidence of the swelling after fracture, and not proportionally loosened as the swelling increased.

The two following are cases of mortification, resulting, the first from simple continued fever, and the second probably after scarlet fever:—

Case 1.—J. J., forty-eight years of age, a hatter by occupation, of intemperate habits, is now—

Aug. 1. Slowly recovering from an attack of fever which commenced seven weeks since. A sore on the inner ankle of the left leg, which he has had for eighteen months, about five weeks since became sloughy, and the surrounding skin was attacked with gangrene, which continued spreading till it has attained its present size, that of the hand. As yet there is not any line of demarcation, and the wound is very painful though cleaning. He is much emaciated, very weak, without appetite, cannot rest, his pulse extremely quick and almost imperceptible, (this may perhaps arise from exhaustion in bringing him to the hospital,) the countenance sunk and pallid, surface warm, but occasionally bathed in profuse sweats, tongue clean. I ordered for him five grains of carbonate of ammonia, with ten minims of tincture of hyoscyamus every six hours, six ounces of brandy and a pint of beef tea, with arrow-root daily. To the wound, chlorate of soda lotion and linseed-meal poultice.

Aug. 2. Better, but without sleep. Twenty minims of tincture of opium at night.

Aug. 4. Is improving; the wound is free from pain, and two or three granulations are seen in its centre; the slough has rather increased. An abscess which has formed on the outside of the knee was opened, and a teaspoonful of thin but otherwise healthy pus discharged; pulse improved; he complains of sore throat, with difficulty in swallowing, and disposition to retch, but he takes plenty of fluid though he cannot manage solid food. As he wished for some porter, a pint daily was ordered. The mixture discontinued; but twenty minims of tincture of opium in camphor mixture directed to be taken at night.

Aug. 9. Is improving, and yesterday began taking a mutton chop. The slough has cleaned from the wound, leaving a sore surface which, occupying nearly two-thirds of the back and inner part of the leg, is now beginning to granulate. As the pus seemed disposed to bag on the outside of the instep, in consequence of the limb lying on its outside, the skin was cut through to prevent this, and a small abscess below the tubercle of the shin-bone opened.

Aug. 15. Improving, and desiring more nourishment. Two pints of beef tea daily.

Aug. 22. The wound almost completely cleaned, but the granulations are flabby and pale. An abscess which has formed at the upper part of the thigh was opened, and about an ounce of good pus evacuated. He wishes to have more porter, which was therefore increased to two pints, and the brandy diminished to four ounces. Nitric acid wash to be applied to the wound.

Sept. 2. During the last two or three days the granulations have been receding, and have now exposed a large portion of the shin-bone, which is apparently dead; a considerable part of the Achilles' tendon has become gangrenous. The drain upon his constitution has lately been much increased, and it is now a question whether amputation be not necessary, and also whether he is in a condition to bear it.

Sept. 6. The wound is more healthy, and the gangrene seems to have stopped. Another abscess, merely superficial, which had formed about the middle of the thigh, burst yesterday.

Sept. 11. Sleeps well and feeds well, but does not get flesh; there has been a slight increase of sloughing on the instep, but it is now cleaning. The discharge from all the wounds is very free, and the granulations rather more florid.

Sept. 13. Appetite failing. An abscess on the inside of the calf, which seems to extend among the muscles, opened, and about three ounces of pus discharged.

Sept. 20. Still declining, and during the last two or three days sloughing has recurred. Amputation was therefore proposed, but he would not consent.

Sept. 24, 9 A. M. Much exhausted; pulse quick and scarcely perceptible; countenance pallid; voice weak; the sore quite bleached. I ordered him brandy and egg, as much as he could be induced to take, which somewhat revived him, and afterwards he took some wine. At 1 A.M. bleeding occurred, probably from the saphenous vein, as it traversed the wound; it was, however, easily checked, and did not recur. He continued gradually sinking, and, on

Sept. 25, 2 P.M. He died.

CASE 2.—E. U., twenty-seven months old, of scrofulous habit, has been weaned about thirteen months, and, like the children of the poor generally, since fed on bread and butter, with tea. She has been always healthy till about sixteen days since, when the whole surface of the body became so scarlet that it was supposed to have scarlet fever. Two days after she was observed to point continually to the left side of her chest, and on examination there was found on the axillary margin of the pectoral muscle a dark-coloured swelling, in circumference about the size of a small tea-cup. Soon after the redness of the body subsided; but her belly was enlarged and the legs swollen. It would, therefore, seem probable that the previous disease was scarlet fever.

At the present time (*Sept.* 8) there is a well-formed brown slough, surrounded with a dusky-red elevated edge of skin with similar inflammation extending about half-way down the left arm, also upon the neck and back, reaching as far as the right shoulder. The cellular tissue of the right arm-pit hard, inelastic, and painful, as if another slough were likely to take place. A layer of the slough was removed, and strong nitric acid applied with a feather; after which it was covered with nitric acid lotion and linseed-meal poultice. To the back of the neck a linseed poultice with acetate of lead wash was applied. Five grains of extract of bark every four hours, and an ounce of gin every six hours, were given in arrow-root.

Sept. 10. The sloughy sore is cleaning; but the hardness on the right shoulder has increased; the inflammatory blush has spread considerably, and now covers all the chest and the belly as far as the navel, extending down on either side towards the flanks. On the left arm it reaches below the elbow, and on the right half down the upper arm. The cellular tissue on the loins is œdematous. As the gin is rejected, a couple of tea-spoonfuls of port wine with syrup was ordered frequently during the day, but not to exceed four ounces. Two grains of mercury with chalk, and four grains of rhubarb with as much carbonate of soda, nightly, were prescribed.

Sept. 11. Has had three dark-coloured stools, but her appearance not improved. She continued sinking, and about 4 P.M. died.

No opportunity of examining her body occurred.—J. F. S.]

26. The mortification dependent on very low vital activity which generally attacks the feet and more rarely the hands of old people (*Senile Gangrene, Gangræna senilis,* Lat.) must be considered as peculiar. Under this name, however, conditions have been classed together which, at least in reference to their origin, must be distinguished from each other.

27. In persons who in every respect have lived irregularly, and whose living powers are in a great degree exhausted, who have suffered much trouble, and had irregular gout, specially in the feet, an erysipelatous inflammation with dusky redness and severe pain arises after any injury,

viz., after the violent action of frost, contusion or wound of the toes in cutting the nails or corns. This redness spreads more or less, forms blackish bladders on one or more toes; the cuticle separates, and the exposed true skin exhibits a deep dusky redness. The inflammation usually spreads still further, but slowly; attacks one after another all the toes; and usually in its progress the part next to be attacked swells, and is excoriated. Sometimes it is circumscribed, in which case the toes dry like mummies and fall off. Most commonly the mortification spreads over the ankle-joint, and in its further extension death ensues from exhaustion: it may, however, be confined to different parts, and nature may bring about a separation of the mortified part. The pain is usually severe, and is soon accompanied with fever.

28. In this kind of mortification the depressed condition of the vascular and nervous activity must be considered as the actual cause why in the operation of the above-mentioned hurts, the inflammation quickly passes into mortification and drying up, mostly of the parts farthest distant from the centre of circulation. This mortification exhibits some similarity to the dry mortification of frostbite.

29. The other form of this mortification happens without any previous local injury, but after general indisposition of more or less duration, such as depression of spirits, listlessness, unquiet sleep, debility, sparing, high-coloured urine, laborious breathing, palpitations of the heart, anxiety, pain at the pit of the stomach, small, weak, irregular, or intermitting pulse, shiverings, or constant internal cold. In the part in which subsequently the gangrenous drying appears, pains of varying severity come on, sometimes accompanied with cramps in the extremities: these go on for weeks, and even for many months, before the local destruction is observed. Or the patient has a sensation of cold in his extremities, a recurring sensation of being asleep for a longer or shorter time, insensibility to external irritation of the fingers and toes, entire loss of motion. Without any local cause the patient observes on his toe or on his finger a black, blackish-brown or brownish (never dusky-red according to BALLING) colour, without any tense swelling. The part dries, the cuticle loosens itself, the part becomes quite black and lifeless. The prognosis of the disease varies: often is only one toe or one joint thrown off, or it attacks all the toes, confines itself to the foot, or spreads up to the knee. The process of separation is connected, as in common mortification, with a bounding red line and slight suppuration. This kind of mortification may occur on various parts at the same time. The same appearances take place in children: the extremity becomes black-blue, its temperature diminishes, and it seems to be completely atrophied. In one case BALLING observed a blackish-yellow colour and dried skin. Sometimes a lower degree occurs, and then from the first the extremities are livid and œdematous.

[This form of mortification is TRAVERS's chronic gangrene, which he says "is generally an idiopathic affection, *i. e.* independent of injury, and which he has never known to be traumatic. * * * The main distinction between this and acute gangrene is, that from the first the part thus affected losing its temperature and colour becomes dry, tough, and shrunken, instead of moist, soft, and swollen, and takes on a yellow or blackish-brown appearance, nearly resembling that of a mummy." (p. 211.)]

30. This form of mortification or mummy-like drying up is always the consequence of an exhaustion in the peripheral parts of the vascular and nervous systems. This condition occurs most commonly in old, decrepid

persons living anxiously and in want of food; more frequently in men than in women; in persons who have prematurely exhausted themselves by excessive debauchery; in those subject to the gout, in whom, perhaps, the ossification of the arteries, so often observed in this kind of mortification, seems to be connected: this disease, however, may occur in every age if the above conditions are present. This kind of mortification may arise suddenly, and without any previous inflammatory symptoms, by metastasis during the course of malignant fever (1). In children born with blue, cold atrophied extremities, in whom the circulation does not proceed properly it is often noticed. The closing up of the blood vessels is, according to Balling (*a*), constantly observed (2). Organic changes in the heart and aorta are also invariably present (3).

(1) I have seen one case in a man thirty-five years old, in whom during the progress of abdominal typhus, the right foot up to the middle of the leg, became suddenly pale, icy cold, senseless and motionless, shrivelled, subsequently quite black, and the dry gangrene reached to the upper third of the leg, where it stopped.

(2) The closing up of the arteries *is always present in dry gangrene*, as was observed in former times; it may be also in certain cases the special cause of the mortification, and consequence of the inflammation of the arteries, (*arteritis*,) or of the capillary vessels, first described by Dupuytren (*b*). It cannot, however, be considered as the general and constant cause; for, in many cases, there is not a single previous appearance indicating inflammation of the arteries, and their closure is caused by the mortification, and consequent to it. Compare also Hecker (*c*).

(3) I have observed a case of dry gangrene in a man about forty years old, which extended up to the middle of the leg, where it stopped, and the part separated. There had existed for a long time undoubted symptoms of organic disease of the heart.

[Brodie (*d*) mentions a case of mortification of the leg up to the middle of the thigh, which commenced with a sense of pricking numbness and weight, and on the following day the limb had mortified; "no vesications formed on the foot; it was not swollen, and no part became putrid except just a little in the middle of the thigh, where was a great mass of soft parts. The limb dried, the skin assuming a brownish colour, being at the same time hard and semi-transparent, so that the white tendons could be seen shining through it. It was in fact what has been called a case of dry gangrene." The patient's powers failed, and he died at the end of six weeks. Upon examination, Brodie "found marks of inflammation everywhere around the principal artery and vein of the limb. From the bifurcation of the large trunk down to the middle of the thigh, the artery was obliterated, being completely filled with coagulated lymph, evidently effused from inflammation; closely adhering to the inner surface, but with some admixture of red coagulum. The vein was filled with lymph and obliterated in the same manner as the artery. There had been inflammation of the sheath of the vessels, in consequence of which the artery and the vein adhered closely to each other and to the surrounding parts. I suppose that the nature of the case is plain enough: there had been inflammation of the artery and the vein, and the obliteration of the artery was to so great an extent as to cut off the supply of blood, not only through the trunk, but through the anastomosing branches." (p. 635.) Brodie also points out the cause of the distinction between dry and moist gangrene:—"If mortification be the result of inflammation or of venous obstruction, there is always an effusion of serum before the parts completely dry, in the form of vesication of the skin and œdema of the cellular membrane; and then, when the parts die, being infiltrated with serum, they readily become putrid. But here (in inflammation of the arteries) the blood is prevented from entering the limb, so that there can be neither vesication nor effusion of serum into the cellular membrane, and the dead parts dry readily from the absence of moisture." * * * Gangrene from arterial inflammation is comparatively a rare disease, and may occur at any period of life; whereas the gangrene of old age arises, as repeated dissections have enabled me to determine, entirely from other causes." (p. 636.) From this latter observation it will be perceived that Brodie does not agree either with Cruvelhier (*e*), who

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(*a*) Ueber die *Gangræna senilis* in Journal von v. Graefe und v. Walther, vol. xiv. p. 42.

(*b*) Transactions Médicales, May, 1833.

(*c*) Nosologisch-therapeutische Untersuchungen über die brandige Zerstorung durch Behinderung der Circulation des Blutes. Stuttg., 1841.

(*d*) As above.

(*e*) Maladies des Artères; in Dictionnaire de Médecine et de Chirurgie Pratiques, vol. iii. p. 394.

says, that "coagulation of the blood is, after his observations, the essential character of incipient *arteritis*," (p. 394;) or with DUPUYTREN (a), who says that, in such cases, "Pathological anatomy always shows the existence of inflammation of the arterial tunics. This phlogosis may doubtless occur in arteries which are unhealthy, indurated, ossified, as often met with in old persons; but it appears also in the arteries of young people without trace of these disorders. In a word, it may coincide with the calcareous incrustation of the vessels and with age, or it may be independent of both conditions." (p. 484.)

I have seen but a single case of *arteritis*, which happened in a young man of twenty years. It differed from BRODIE's case in not having exhibited the slightest appearance of gangrene, and, on dissection, the brachial artery was found partially obliterated, and shrivelled to a narrow cord, precisely as if a ligature had been applied upon the subclavian artery. Although, in this case, the pulse at the wrist ceased suddenly, yet the circulation was undoubtedly carried on by the collateral circulation, and thus gangrene prevented. I shall refer to this case again when considering inflammation of the coats of arteries. (p. 74.)—J. F. S.

A most remarkable case is given by SOLLY (b) of gangrene, which commenced in a boy about three years old, and, gradually spreading from limb to limb, destroyed him when four years old. In four months from its commencement the disease had amputated the left foot above the ankle, as also two toes of the right foot, and upon the right calf and knee were hard gangrenous spots. The right fore arm was cut off through the middle of the ulna, and the radius had dislocated itself from the elbow joint; the whole of the left fore arm and part of the upper arm were gangrenous. There was a dusky spot on the nose upon the scar left by a gangrenous spot which had formed previously, and separated. In the sixth month the left leg, which had become quite gangrenous, was thrown off below the knee, and the toes of the right foot had also sloughed off. The right ulna had come off at the elbow-joint, and the left arm had amputated itself through the middle of the upper arm. The gangrene on the nose had reappeared, but been checked. For a short time there seemed a little rest in the gangrenous process; but it was again set up, and by the twelfth month the left leg had become gangrenous to the middle of the thigh, and all the soft parts separated, leaving the bone bare. The right leg had mortified to the middle of the calf, and the right foot separated above the ankle. The stumps of both arms had become gangrenous up to the shoulders. In the beginning of the following month the child died. Careful examination of the body did not show any organic disease; but the child had become much emaciated. The stumps of the arms had nearly healed; but in the lower limbs the bones protruded, and the cure was less perfect.]

31. Mortification from continued pressure, or from constant lying upon one part (*gangræna ex decubitu*) occurs more readily, the weaker the patient, and the less cleanly and smooth the bed is. On those places where the pressure acts, most commonly, therefore, on the sacrum and coccyx, the great trochanters, the shoulder-blades, elbows, heels, and so on, a limited redness appears, with pain more or less severe, the skin is destroyed by ulcerative absorption, and a dry slough is formed, which is dissolved in the suppuration set up around it. Should the pressure continue, and the general weakness be great, (for example, in typhus fever,) the destruction spreads very extensively, and in many cases death is thereby accelerated or even caused.

32. A special mention is required of that mortification which, in certain localities, in very wet and humid years, when the rye is infected with the blight, called "cockspur," occurs in the lower extremities, with a constant sensation of itching, great burning, and a darting pain, sometimes with redness and swelling, consequent on which the parts become cold, senseless, black, mummy-like, and shrivelled up. In rare cases this disease has been also observed in the upper extremities. During the course of the disease general symptoms, fever, delirium, and so on frequently arise. Oftentimes the mortification becomes defined and the part is thrown off, and often it spreads up to the hip-joint.

(a) Leçons Orales de Clinique Chirurgicale, vol. iv.

(b) Med.-Chir. Trans., vol. xxii. p. 253, 1839; vol. xxiii. p. 237, 1840.

[A very interesting account of mortification from the use of rye-bread affected with cockspur (*secale cornutum*, Lat.; *Mutterkorn*, Germ.; *ergot*, Fr.) has been given by **Thomson**. "This is," says he, "a species of mortification which has not been observed in this country; but it is well known and has been frequently observed in different parts of the continent of Europe, particularly in France, where it has been repeatedly known to prevail in some districts as an endemial disease." (p. 538.) **Pereira** (*a*) supposes this disease is referred to in a passage he quotes from **Sigebert**. "1089, a pestilent year, especially in the western parts of Lorraine, where many persons became putrid, in consequence of their inward parts being consumed by St. Anthony's fire. Their limbs were rotten and became black coal. They either perished miserably or, deprived of their hands and feet, were reserved for a more miserable life." He also refers to a similar passage in **Bayle**, with the addition, that "the bread which was eaten at this period was remarkable for its deep violet colour." (part ii. p. 595.) **Thomson** says, the disease was first noticed by **Dodard** in 1676; then by **Saviard** (*b*), in 1694; and by **Noel** (*c*), in 1710, in the Hôtel Dieu at Orleans, of which they were both surgeons; in 1709 and 1716 it appeared in Switzerland, and was described by **Langius** (*d*); **Quassoud**, and also **Bossau**, described it on its appearance in Dauphiny in 1709. **Duhamel** (*e*) mentions that in 1748 not more than four or five persons out of a hundred and twenty who had been attacked escaped with life. **Elliotson** some years since had, in St. Thomas's Hospital, a case of gangrene of the leg after using ergot; but he informs me that on examination after death the arteries of the limb were found ossified: it might, however, have been the immediate exciting cause of the disease.

Although there was no doubt that in man the cockspur would produce gangrene, **Model** (*f*), a Russian, made experiments which led him to conclude that rye, damaged with cockspur, had not the power of exciting gangrene in brutes. This remarkable statement induced the Royal Society of Medicine at Paris to employ **Tessier** (*g*) to visit those countries where the disease was prevalent, and to institute experiments to determine the fact, and the result showed that brutes eating it were destroyed by gangrene; but, in all the animals upon which it was tried a certain quantity, varying according to circumstances, of the cockspur was required to be taken, in order to produce the effect; and, as **Thomson** says, "this afforded also a simple explanation of the fact, that persons might live for a considerable time upon rye affected with cockspur without suffering any sensible injury from its use." (p. 547.) **Pereira** states, however, that "there are not wanting cases apparently showing that spurred rye has no injurious action on animals. The most remarkable and striking are those related by **Block**. In 1811 twenty sheep ate together nine pounds of it daily for four weeks without any ill effects. In another instance twenty sheep consumed thirteen pounds and a half daily for two months without injury. Thirty cows took together twenty-seven pounds daily for three months with impunity, and two fat cows took, in addition, nine pounds of ergot daily, with no other obvious effect than that their milk gave a bad caseous cream, which did not yield good butter. These statements furnish another proof to the toxicologist that the ruminants suffer less from vegetable poisons than other mammals." (p. 600.)

A very curious history of a mother and five children, some of whom lost one and others both legs, as related by Dr. C. **Woolaston** (*h*), seems to have originated in the use of discoloured clog-wheat.

Ergotism, as the disease produced by the cockspurred wheat or rye is called by the French, is of two kinds, the *convulsive* and the *gangrenous*; with the latter only have we to do here; it sets in with formication, or the feeling of insects creeping over the skin, voracious appetite, coldness and insensibility of the extremities, followed with gangrene.]

[32.* Here must also be mentioned that mortification of the cheek which has been called *Noma* by **Vogel**. It is fortunately not frequent, as it is a horrible and generally fatal disease. With a single exception, of the half dozen cases I have seen, all were children under four or three years old; some idiopathic, and others originating in a sloughing of the mucous membrane of the mouth, under the careless use of mercurials; and, though

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(*a*) Elements of Materia Medica, part ii. London, 1840. 8vo.

(*b*) Journal des Savans, 1676, p. 76.

(*c*) Mémoires de l'Académie Royale des Sciences de Paris, 1710, p. 61.

(*d*) Descriptio Morborum ex esu Clavorum Secalinorum.

(*e*) Mémoires de l'Académie Royale de Paris, 1748, p. 528.

(*f*) **Bomare**, Dictionnaire d'Histoire Naturelle. vol. xix.

(*g*) Mémoires de la Société Royale de Médecine, 1776, p. 254, 1777-8, p. 587

(*h*) Philos. Trans., 1762, p. 523.

generally in unhealthy subjects, yet the disease also occurred in robust, well-fed children. In its idiopathic form it has been well described, by Drs. **Evanson** and **Maunsell** (*a*), as follows:—"A particular form of gangrene of the mouth, without any preceding inflammation, occasionally attacks infants, especially such as are feeble at birth or broken down by disease. An œdematous circumscribed swelling appears on the cheek, with a central point, more or less hard, over which occurs a dark-red spot. This spot may appear on the inside or outside of the cheek; and the skin over the œdematous part is characterized by an oily appearance. An eschar forms from within outwards on the central point, and the soft parts mortify, often extensively, down to the bone, so that the parietes of the cheeks and gums are destroyed, falling off in shreds, mixed with a dark sanguineous fluid, and accompanied by a very fetid odour." (p. 214.) In neither of my cases, excepting the adult, did I witness the beginning of the disease; but gangrene to a greater or less extent of one cheek, involving generally the corresponding half of the upper lip, existed when the children were brought to me; the surrounding parts were tumid, hard, and of dull yellow-white hue, very similar to the characteristic colour of the countenance of patients under malignant disease. I have little doubt that the mortification of the mouth and fauces after measles, mentioned by **Huxham** (*b*), as well as those referred to by **Marshall Hall** (*c*), and by him stated to have happened after previous disorder of the digestive organs, typhus fever, or some inflammatory disease, are of precisely the same character as those resulting from mercurial influence. The little patient, if not already in a typhoid state, soon falls into it, rapidly sinks as the gangrene spreads, and quickly dies; often, indeed, before the least attempt at separation of the slough has been made. Usually three or four days are sufficient to destroy life; but, in one instance, I recollect a child of two years old having lived for a fortnight, and the greater part of the gangrenous cheek had separated, leaving one side of the cavity of the mouth completely exposed. I fully agree with **Evanson** and **Maunsell**, that "no disease can be more frightful or formidable than sloughing of the mouth in children. Recovery seems impossible, when once the disease has set severely in, the child sinking beneath the constitutional disturbance, independent of the local ravages of the disorder, which, however, are often such as to render recovery not to be desired, so frightful is the deformity necessarily entailed." (p. 215.)

The term *Cancrum oris* has been loosely applied both to the disease just mentioned, and also to another form of mortification commencing with ulceration, generally first in the gums, and thence spreading to the lips and cheeks. This second form alone is considered by Dr. **Cumming** (*d*) to be *cancrum*. He describes it as being either acute or chronic, and, if the former, more liable to be accompanied with sloughing, but the ulcerative process predominates, and by it, principally, the destruction is effected. It does not, according to this writer, attack children at the breast, nor under eighteen months, but occurs between twenty months and seven years.

The following is a short account of the case of noma in the adult alluded to above:—

R. I., a gunmaker by trade, was admitted under my care—

(*a*) A Practical Treatise on the Management and Diseases of Children. 2nd Edit. Dublin, 1838. 8vo.

(*b*) Reports, July, 1745.

(*c*) On a peculiar species of Gangrenous Ulcer which affects the Face in Children; in Edinburgh Medical and Surgical Journal, vol. xv. p. 547.

(*d*) Dublin Hospital Reports, vol. iv. p. 18.

August 1, 1844. Having two superficial sores on the glans penis and a superficial sore on the back of the pharynx, sloughy and painful, so much so as to prevent him sleeping at night. He is much out of health; quick, irritable pulse; hot, dry skin and foul tongue. He has also a very small sore, scarcely perceptible, and covered with a dry scab, on the face near the nostril. He was not seen till

August 2. Probably from not having come in, and then ordered *pulv. rhei c. hydr.* ℈j. *stat; sod. carb. gr.* xv. *acid. citr. gr.* x. *tinct. hyoscyam.* ʒss. *aq. distill.* ℥jss. 6*tis horis; garg. acid. nitr.*

August 6. The mixture omitted, and in its stead ordered *acid. nitr.* ♏ iij. *inf. rosar.* ℥jss. *ter die. pulv. ipec. c. gr.* x. On

August 9. Very restless, scarcely sleeps at all; and is so feeble that he can hardly answer the questions put to him. Ordered a glass of wine and a pint of porter daily, and *morph. mur. gr.* ⅛. On

August 15. Has slept better since taking the morphia. The crust under the right nostril has increased in size and is accompanied with swelling of the surrounding parts, which are of a purplish colour.

August 17. Is much worse; the lip immensely swollen and livid, but not giving any discharge; face so much disfigured that he can scarcely be recognised. The sore in the throat much worse; bowels confined. ℞ *pulv. rhei. c. hydr. gr.* xv. *stat; vin. rubr.* ℥vj. *quotid.*

August 20. Is very feeble and unable to speak. The slough has now extended around the mouth from the nose to the chin, including the lips and part of both cheeks. The sore in the throat has become very sloughy. Four ounces of brandy, three eggs and some arrow-root were ordered; but he was not able to take much, and gradually sunk till

11. *p.m.* When he died. No discharge at all had occurred from the lip. No examination of the body was made.—J. F. S.]

33. Mortification occurs as a consequence of contagious influence, either by the contagious matter producing at first an inflammation which terminates in mortification, (*malignant pustule*,) or by coming in contact with the surface of a wound or sore, whereby the destruction of it is brought about (*hospital gangrene*.)

34. The ***Malignant Pustule*** (***Pustula maligna***, Lat.; ***bösartige Pustel***, Germ.; ***Pustule maligne***, Fr.) is always consequent on local contagion. On the place which the contagious matter has touched, there appears in a short time prickling and a red point, which is scarcely raised above the skin. The cuticle rises in a blackish vesicle, which is soon converted into a slough surrounded by a whitish or violet edge and œdematous swelling, and spreads quickly in all directions. From the very onset there is perceived in the pustule a hard nucleus, which enlarges both inwards and outwards, or only spreads laterally. Notwithstanding the decided swelling, the patient complains rather of tension than of actual pain. Sooner or later it is accompanied with fever, pain in the region of the stomach, nausea, vomiting, high delirium, fainting, and so on. The pulse is small, irregular, and, if left to itself, the disease generally runs on to death, which in malignant cases follows very speedily. It is rarely that the slough comes away, and that the cure is effected by the mere powers of nature, or that in the course of this disease the general symptoms already mentioned do not appear. If several pustules are formed at the same time, especially on the neck or face, the disease is more dangerous. The swelling is often here so great that symptoms of suffocation and congestion of the brain are produced. In women the disease proceeds more quickly than in men. At the onset a stop may usually be put to this disease; the danger increases in its subsequent course. It differs from carbuncle (*par.* 118.)

The contagion develops itself in beasts which are affected with contagious carbuncle (*Milzbrand*;) it may be communicated whilst the animal is alive, or it may take place during the preparation of wool, hides, and so on. The malignant pustule is therefore most commonly observed in butchers, tanners, woolbeaters, shepherds, and especially on those parts of the body usually uncovered. In wet districts, in moist autumns, the disease is most common. The contagion preserves its power for a long period. Actual contact is not always necessary to produce infection. The use of the flesh of such beasts sometimes does not produce any, but at other times very dangerous, symptoms. This disease seems not to be communicable from one man to another, at least the facts relating thereto are not perfectly indisputable; it is also doubtful whether the general symptoms can be produced by the assumption of this contagion into the body, without the malignant pustule on the skin.

Precisely similar phenomena have been observed in reference to the transference of the poison of glanders from horses; upon which see the article entitled

Ansteckung, Uebertragung des Ansteckungstoffes von Thieren auf Menschen, in Hufeland's Journal, vol. iv. part iii. p. 57, which contains the following three notices:—

Remer, W., Ein Beitrag zu den bisherigen Beobaetungen von Krankheiten der Thiere, welche sich dem Menschen mitgetheilt haben.

Schilling, Merkwürdige Krankheits-und sections-Geschichte einer wahrscheinlich durch Uebertragung eines thierischen Giftes erzeugten schwarzen Blatter. (This notice is also in Rust's Magazin, vol. ii. p. 480.)

Meier, Tödtliche Uebertragung des Milzbrandes auf Menschen.

See also,

Tarozzi, Tommaso, Casi di Malattia Pestiforme nata in diverse persone che convenivano in una stalla in cui era un cavallo moccioso; in Omodei's Annali Universali di Medicina, 1822, vol. xxiii. p. 220.

Seidler, Geschichte einer muthmasslieh durch Uebertragung eines thierischen Kranhheitsstoffes erzeugten merkwürdigen, in tödtlichen Brand ubergegangenen Gesichtrose, in Rust's Magazin, vol. xvii. p. 161.

Eck, Beitrag zu den Erfahrungen über die schädlichen Einwirkungen des Rotzgiftes des Pferde; in Medinischer Vereinszeitung für Preussen. 1837. 3rd May.

Elliotson, John, M.D., On the Glanders in the Human Subject, in Med.-Chir. Trans., vol. xvi. p. 171. Additional Facts respecting Glanders in the Human Subject, ib., vol. xviii. p. 201.

[Elliotson has given a very excellent account of "The Glanders in the Human Subject," in which the communication of the disease from the horse to the patient is distinctly made out. He mentions six cases; the first three he considers *acute*, two of which occurred in St. Thomas's Hospital, and both died very speedily after having been attacked; the third occurred in a dragoon regiment in Ireland; the fourth was a veterinary surgeon at Clapham; both died. Two cases, which he calls *chronic*, extracted from Travers's book "On Constitutional Irritation," one of which died, and the other long suffered from a broken-up constitution. He also refers to the cases mentioned in Rust and Omodei's journals. In a subsequent paper he gives "Additional Facts respecting Glanders in the Human Subject," in which he mentions another case that occurred in St. Thomas's Hospital, which also died.

I have to thank my friend Lawrence for the following observations of the cases of malignant pustule which have come under his care, and which, on account of their rarity I gladly avail myself of the opportunity to introduce on the present occasions. He says:—

"I have had under my care, in St. Bartholomew's Hospital, three cases of malignant pustule, in neither of which, however, did I see *either pustule or vesicle*; of the first and most remarkable, the following is the report from the Lancet of 1825-6, p. 127, in which it is described as "*A singular case of Erysipelatous Inflammation of the lower Eyelid, terminating in gangrene in the short space of six hours.*"

John Barker, aged 52 years, currier, stout and robust, came to the Ophthalmic Institution, and, immediately after, in consequence of the nature of his ailment, by Mr. LAWRENCE's advice, was sent into St. Bartholomew's Hospital.

Feb. 18, 1826. He stated, that the day before yesterday, whilst at his usual employment, he struck his right eye with a skin of leather, which at the time caused him great pain and uneasiness. At this time there is an erysipelatous inflammation extending around the organ, but more especially on the lower lid and adjacent portion of the cheek, in the centre of which there is a hard and indurated lump, more prominent than the rest, feeling like carbuncle. It has a very livid hue, and may be said to have gone into a state of gangrene. Since his admission into the hospital, he has not complained of any particular pain in the part, nor is the constitution apparently much affected; the tongue is but slightly loaded; the pulse feeble. Mr. LAWRENCE made an incision through this hard and indurated portion, when a little dark blood escaped. The globe of the eye not in the least affected. Two grains of sulphate of quinine to be taken every six hours, and six ounces of port wine, daily.

Feb. 22. The pulse having been quickened last night, the wine has been in consequence discontinued; and a dose of house medicine given this morning.

The tumefaction above the lid still continues, and there is now a distinct line of demarcation around the gangrenous spot before alluded to. The whole of the inflamed skin, has a peculiar, hard, brawny feel, very similar to carbuncular inflammation. Mr. LAWRENCE stated, that when the man came to the infirmary, there was no unusual vascularity of the eye; a slight serous effusion only had taken place beneath the conjunctiva palpebræ. A slight puffiness is observable about the under lid of the corresponding eye, but there is no redness. Pulse soft and compressible; bowels open and tongue moist. The quinine to be continued; the wine resumed, but omitted at night if necessary.

Feb. 25. Has passed a good night and the condition of the parts is improved. The wine and bark, being too stimulating, are both discontinued. A more scarlet or what may be termed phlegmonous inflammation now surrounds the dark gangrenous portion of skin, which is about the size of a half crown in extent; and the contiguous parts have a less brawny feel. Pulse 90, soft, and the patient free from any particular pain. Wears a poultice to the part and takes saline mixture.

March 1. But little constitutional derangement is manifest. The eye examined to-day, but presented no unnatural appearance. Neither of the tarsi are implicated, although the swelling commences immediately below the lower one. To continue as before.

Mr. LAWRENCE observed, that BEER only mentions two cases wherein such a sudden change had taken place, and those resulting from the sting of bees, whereas, in the present instance, the mere contact of the leather had produced it. He also remarked that the only author who had mentioned any case like the present was M. DELPECH of Montpelier, who has described two or three cases as occurring in butchers and tanners, where the parts went into a state of mortification in the space of a day or two after the occurrence of the accident, although there was no severe contusion of the parts. He ascribes it to some peculiarity in the skin with which they were struck.

March 7. The process of separation goes on favourably; that portion of the slough which is nearest the eyelid has become detached, and is found to extend to some depth. The bowels are kept open by medicine, and a poultice is applied to the part.

March 10. A portion of the slough was removed to-day. For the last two days, as he has had a feeble pulse and complained of great weakness, six ounces of wine, daily, have been allowed.

March 13. The whole of the slough has now been detached, and, as was suspected, the tarsus is quite undermined along its central part, which has caused its dropping, and, consequently, a degree of ectropium. The surface of the sore discharges pretty freely, but has a healthy aspect. Continue as before.

March 16. Every thing to be omitted but the wine.

March 19. The edges of the sore have already considerably approximated, and the granulations have nearly rendered it a mere superficial ulceration. Continue as before. Mr. LAWRENCE says, that he shall be obliged, at a future period, to remove the everted portion of the conjunctiva palpebræ.

March 23. The ectropium is lessened, and cicatrization of the sore only now remains to complete the cure. The man was permitted to leave the hospital, and to continue his visits to the Eye Infirmary if he found necessary.

In reference to this case LAWRENCE observes, in his note, "the essential circumstances of this case were a reddened and thickened state of the skin on the cheek, just below the eye-lid, presenting, at the first view, the aspect of incipient erysipelas; speedy mortification of the reddened part, and its slow separation, the mortification including the subjacent textures, so that the cicatrix was fixed to the bone, and the lower lid partially drawn down; absence of constitutional disturbance.

"In the other instances," he continues, "both of which were persons employed in a horsehair manufactory, the skin had sloughed before they came to the hospital. The affected portions were circular, the size of a shilling in one, on the front of the chest; that of a sixpence in the other, on the fore arm. There were no other local symptoms, nor the slightest constitutional disturbance."

Turchetti (*a*) has given, under the name of Anthrax, an account of some cases of malignant pustule, which occurred in 1841, after eating diseased flesh of cattle which had died of an epidemic anthrax of the tongue, and had been sold in the market of Fuceechio. In some persons, small, and very painful tubercles, with a red areola, or small whitish pustules, encircled with purple or violet, appeared on the face, lips, neck, or arms, gradually increasing in size until in the space of from one to three days they presented the genuine characters of anthrax. In the greatest number of these cases the slough separated in the course of a week, leaving a more or less healthy ulcer, which cicatrized speedily. In the more severe cases the pustules ran together, the inflammation spread like erysipelas, with extensive livid swelling and obstinate disorder of the alimentary canal. The sloughs did not separate for a fortnight, and left very foul ulcers, which healed with great difficulty. Two elderly persons died of this disease. A young man, eighteen years old, was attacked twenty-eight hours after taking this food with an anthrax on the left upper eyelid, whence followed mortification of the whole of that side of the face and neck, and part of the chest. At the end of a fortnight the slough cleared off, leaving an enormous ulcer, which suppurated freely and healed slowly.

Dr. Wagner (*b*) relates several cases of malignant pustule produced in man and beasts, both by contact and by eating the flesh of diseased animals, which happened at the village of Striesa in Saxony. On the 13th of July, 1834, a herd of cattle having been brought from the pastures to the village, the bull fell to the ground, and was incapable of getting up again. Supposing that it had met with some injury in the loins which would render it useless, it was destroyed by shooting through the head, as happened to be most convenient, and then, having been dressed and cut up by two labourers, the meat was distributed among the villagers. A few days after, some more cattle on the same farm died, and were skinned by the same persons; but the meat was not used as food, as almost all the persons who had eaten of the first beast had felt more or less unwell, mostly, however, complaining only of weight at the pit of the stomach, and pain in the belly, without fever: but, several, especially the two persons who had both dressed the animal and also eaten its flesh, complained severely of soreness of the limbs, dizziness and debility. Between the 15th and 18th of the month several more beasts dropped and died without any previous illness. On examining their bodies the spleen was found completely gangrenous and in so broken up a state that when cut into it presented a black paste-like mass, which readily flowed out: there were also other inflammatory marks in the belly, and hydatids here and there beneath the skin, especially about the neck. One of the flayers, notwithstanding his uncomfortable feelings, proceeded to a village three leagues off, which he accomplished; but, on attempting to return, was attacked with colic and vomiting, and some hours after was found on the ground suffering severe pain, and passing black blood by stool; his limbs were cold, and soon became attacked with cramp; the whole body like ice; the eyes sunken; and he died vomiting, passing bloody stools, and under great anxiety. One widow woman, of thirty years, who had eaten the flesh, but otherwise not touched the animal, complained of oppression at the heart, and weight of the limbs, had a black pustule on the thigh, felt herself very ill in the evening, went to bed, and early in the morning was found dead. Other persons had pustules on different parts of the body. Two very remarkable cases occurred eight days after any beast had been affected with diseased spleen; both were women, one of twenty-six, and the other of fifty years, and in them the pustules were well marked, and the general symptoms similar to the other cases. The latter patient said she had been bitten by a fly upon the back of the neck, at which part the carbuncle appeared; and the former, that she also had been bitten on the right upper arm, by a

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(*a*) Sopra alcuni casi di Malattia Carbonchiosa nata per ingestione delle carni di bue perito di glosso-anthrace; in Omodei's Annali Universali di Medicina, vol. cii p. 276. 1842.

(*b*) Uebertragung des Milzbrandgiftes auf Menschen und Thiere sowohl durch Berührung, als durch Genuss des Fleisches; in Hufeland's and Osann's Journal der practischen Heilkunde, October, 1834, p. 1.

gnat. Upon inquiry, **Wagner** found that the skin of one of the infected beasts had been hung on a neighbouring wall, and thought it very possible that the insects might have been attracted to them by the smell, and had thence conveyed the poison.

A very interesting paper upon malignant pustule has within the last two years been published by Dr. **Bourgeois** (*a*) illustrated with numerous cases. He states that the disease appears in from one to three days on the point where the *virus charbonneux* has been deposited, as a little reddish spot almost always of a deep hue, sometimes accompanied with itching, at other times without. It resembles a gnat-bite, is very ephemeral, and soon followed by a little vesicle slightly puckered, of the same colour, containing a small drop of reddish serosity. Sometimes, instead of this mark, the vesicle is preceded by a solid pimple as big as a pin's head, more or less brown and rosy in some cases. The vesicle thus formed is accompanied with a sensation of great itching, and sometimes shivering, but is rarely painful. The patient scratches off the vesicle with his nail, and the itching generally ceases for a few hours, after which, around the scratched pimple, which is dry and yellowish, a regular circle of vesicles, similar to the first, but larger, are formed. In the centre of the circle, now only a few millimètres in diameter, a little brownish depression, deprived of its cuticle, and formed by the skin, on which rests the primitive ampulla, mortified, and forming a dry and very hard scar, and including the whole thickness of the skin. This continues enlarging, and fresh vesicles are formed around its margin. In from twenty-four to forty-eight hours the flesh on which the pustule rests swells, hardens, and forms a tumour more or less sensible, rarely deficient, and generally roundish, but sometimes oval, and of variable size; this he calls the *tumeur charbonneuse*, on the top of which, but rarely occupying its whole extent, is the pustule. That part not covered with vesicles is of a livid red, and spreading more or less on the neighbouring tegument. The middle part of the tumour is especially depressed, but the whole limb, head, trunk, or several of these parts, may simultaneously acquire an enormous size. As the pustule continues increasing, the redness spreads further, and fresh vesicles are developed. At this time the parts, if touched, have, in many cases, a hardness equal to that of a schirrous breast, but gradually soften at a greater distance from the centre, become tremulous, and even œdematous. But **Bourgeois** says he has never noticed the emphysema mentioned by authors, and copied by one writer from another. The heat of the diseased part, at first very great, by degrees diminishes, till it becomes quite cold. On the limbs red tracks of inflamed superficial absorbents are constantly noticed.

Before the parts in the neighbourhood of the tumour swell, there is most generally constitutional impregnation; the patient has lassitude, headache, the tongue is covered with a whitish coat more or less thick, the appetite diminishes, the pulse is full, rather frequent and soft. More rarely these symptoms do not appear till the disease is accompanied with considerable swelling.

If the disease be not arrested, the swelling extends more and more; the parts become enormously swollen, the phlyctænæ increase in number, and the scar in size, with scarcely any pain, but there is only weight and numbness of the affected parts. The general symptoms, however, become more formidable, the pulse small, quick, narrow, depressible and irregular; frequent vomiting of yellow or greenish bilious matter; violent thirst, faintings; singing in the ears; somnolence; urine scanty, red and brick-dusty; difficult motions, but at other times, and, very rarely, very fetid purging; the skin, at first hot and perspiring, becomes covered with cold clammy sweat; respiration more or less difficult; in the greater number of cases the intelligence remains undisturbed, but in some there is violent delirium. Subsequently the pulse ceases at the wrist, the body is covered with a cold sweat; the voice quenched; the skin becomes bluish; there is a sensation of burning heat within the body; unquenchable thirst; threatening suffocation; the patient cannot sit up; no urine; extreme anxiety, and finally death puts an end to this frightful condition, generally without pain.

Bourgeois says, that he has never observed the dull delirium mentioned in books, and that, with the exception of one case in which the patient had evidently an affection of the brain, all he saw were sensible to the last. Nor has he ever seen the enormous eschars attacking all the soft parts of a limb or spreading to a great extent, as mentioned by writers in general.

Authors have usually divided the disease into four stages, without including that of the incubation of the disease: these, however, **Bourgeois** considers arbitrary, and thinks that there are only two distinct periods in the course of malignant pustule; the first commences with the appearance of the primitive malignant spot, which he calls the

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(*a*) Mémoire sur la Pustule Maligne, spécialement sur celle qu'on observe dans la Beauce; in Archives Générales de Médecine, &c., Fourth Series, vol. i. pp. 172, 334. 1843.

local period or *first period.* The second, which he designates under the name of the *period of impregnation* or *intoxication*, commences with the first general symptoms and terminates only with death or cure." The course of the disease is very variable; it may terminate in two or three days or extend to the fourteenth. The first period is generally the shortest but he has noticed it running on to the fifth day; the second varies from thirty-six hours to eight or nine days.]

For the Literature of Malignant Pustule, see p. 97.

35. Hospital Gangrene (*Gangræna nosocomialis*, Lat.; *Hospitalbrand*, Germ.; *Pourriture d'hôpital*, Fr.) consists of a peculiar decomposition of organic parts appearing under manifold forms. A wound or sore begins to be painful, the edges inflame, the suppuration becomes less and of a serous character. Some days after, on certain parts, or on the whole extent of the wound appears a whitish, thin, semi-transparent membrane pretty firmly connected with its surface, which increases in thickness and extent, and gives the whole surface a grayish-white appearance. This mass cannot be removed, and, if it be attempted, only a part of the whole which is firmly connected with the wound, can be removed. The wound increases in all directions; the edges become still more painful, œdematous, and the œdema spreads. Sometimes hospital gangrene commences also with painfulness of the suppurating surface; but upon it are observed more or less deep cavities, the edges of which are dusky red, and covered with yellowish, white, consistent pus. These ulcerous spots increase and run together; a bloody ichorous fluid is secreted, and the surface of the sore increases in all directions. Lines of inflamed lymphatic vessels commonly stretch to the neighbouring glands. The destruction is often restricted to the cellular tissue; but, in more decided cases, the muscles and all parts without distinction are destroyed. Bleeding often occurs from the destroyed vessels. The bones resist for a long while, but finally give way.

With these local appearances there is always loss of appetite, pain in the region of the stomach, disposition to vomit, costiveness, loss of sleep, a quick and rather weak than strong pulse, hot skin, great anxiety, and restlessness. In the more severe form of the disease all the symptoms of typhus fever come on. These general symptoms often precede the local. The severity and course of this disease as well as its continuance vary in different persons. If it be long continued or often recur, hectic fever and exhausting purging at last set in.

In some cases the hospital gangrene arises in form of a little inflamed pimple or vesicle, without any preceding injury to the part being perceptible (*a*). Hospital gangrene is quite different from the scrofulous complication of sores and wounds.

[Liston (*b*) gives the following brief account of hospital gangrene, as it appeared in University College Hospital, in the year 1841. The case he mentions followed the removal of some metacarpal bones and fingers. "All at once, the stump, which had been healing kindly, assumed a carious appearance; it became enormously swollen within a few hours, and profuse hæmorrhage took place, which there was considerable difficulty in stopping. This might have been, and was sure enough by some who saw it, taken for malignant disease; but it was exactly like what I had seen before in unhealthy seasons, and in badly-regulated hospitals. The season was a very severe one; there had been a great snow-storm, with very cold weather of long duration. Not many days passed over before a number of wounds assumed the same appearance; the parts got puffy round about them, the discharge became slimy and tenacious, very putrid; and bloody fetid gas filled the cellular tissue around them. They extended rapidly, presenting a circular form. Many patients lost a considerable quantity of

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(*a*) Thomson, as above, p. 460.

(*b*) Lectures on the Operations of Surgery, &c., in Lancet (New Series), vol. i. p. 57, 1844–5.

blood; in fact, we were visited by a rather rare disease, hospital gangrene, one which I trust I may never see again. Luckily, out of a good many patients who were so attacked, and in all parts of the hospital almost simultaneously, not one perished. Many of the wounds and ulcers were frightfully extended; but they speedily got clean, and healed soon afterwards very kindly. * * * After the separation of the sloughs, a *circular* clean granulating surface was left. We were at a loss to account for this invasion: there was nothing as regarded the hospital, its ventilation, or drainage, or management, the dressing of sores, &c., that could be blamed. The disease came upon us suddenly, and as suddenly disappeared; and I need not tell you that we have seen nothing of the kind since."

My friend ARNOTT informs me that in January, 1835, in one of the female wards of Middlesex Hospital three cases occurred which might be classed under the head of hospital gangrene, of which the following is a short account:—

CASE 1.—The disease attacked a common ulcer of the leg; the surface became black and pulpy, with a broad very red margin of integument, a raised edge, and great pain. From the size of half-a-crown, the disease extended and occupied, ere it was stopped, a space of a large wash-hand saucer, exposing the muscles and bone. It was arrested by the application of pure nitric acid, and the removal of the patient into another ward.

CASE 2.—The disease appeared on an ulcer by the side of the anus, presented the same character, but was arrested by balsam of Peru, locally, and a grain of opium every six hours, internally. The disease recurred, and the patient was removed from the hospital.

CASE 3.—A punctured wound of the chest did not heal, but that of the integument enlarged by the conversion of the tissue into a grayish pulpy substance, (not black, and without the fiery margin and intense pain of the other cases,) more like phagedæna. It was stopped by balsam of Peru. "I have never seen," he says, "a similar case in the Middlesex Hospital before or since."

I have mentioned the above cases of hospital gangrene, because they are, as far as I can ascertain, the only instances of the disease which have been seen in either of the London hospitals for many years. Cases occurred many years since in the old Westminster Hospital, and also in the York Hospital at Chelsea, which latter being a military establishment, the disease was believed to have been brought home by the sick and wounded soldiers from abroad. With these exceptions, I have the best grounds for stating that in no other hospital in London has it existed in the memory of either of the present surgeons; so that it is a disease entirely unknown to them, excepting to the few who have seen it elsewhere.

LAWRENCE (*a*), speaking of sloughing phagedæna, observes "that these occurrences generally take place in women of the town under the particular circumstances I have now stated; but it is by no means exclusively confined to cases in which the origin might be supposed to be *venereal.* I remember a very bad instance in this (St. Bartholomew's) hospital, in a case that was under the care of Dr. LATHAM, by whom I was requested to see it on account of the sloughing phagedæna. It was a young woman who had had the small pox very badly. The disease had rendered her very weak, and diarrhœa came on. There was a considerable discharge from the vagina, and a constant moisture of the parts by a discharge from the rectum. Thus the skin of the nates became highly inflamed, and in fact a large excavation of sloughing phagedæna formed on each buttock, and she was reduced to a very low state by the disease. Dr. LATHAM asked me what I thought could be done; and, having examined her, I thought badly of the case, but that we might destroy the excavations in her buttocks, which were nearly as large as a good sized teacup, and possessing all the characters that I have mentioned. They were treated by nitric acid applied with lint wrapped round the end of a probe till the sore was saturated with it, and a brown escar produced; the surrounding parts having been previously well dried, to prevent the spreading of the acid beyond the sore. Port wine was liberally allowed her and she got well. This was a cause of a common kind, in which you could not ascribe the effect to syphilitic disease. Now, as far as I can understand the affection called *hospital gangrene,* it is the same as the sloughing phagedæna I have now described." (p. 454.) I think there is little doubt that this was a case of hospital gangrene and not of the so-called sloughing phagedæna. But it is difficult to make out whether LAWRENCE holds them as distinct or as the same disease; though probably the former, as, in speaking of "the treatment" of hospital gangrene, specially, he says, it, "in other respects, is the same as I have mentioned for sloughing phagedæna." (p. 455.)

(*a*) Lectures, as above.

I cannot agree with **Samuel Cooper**, that the sloughing phagedæna, of which an account, founded on the cases to which **Lawrence** refers in his Lectures, is given by **Welbank** (*a*), "certainly resembles hospital gangrene," as described in books. The sloughing phagedæna was certainly an endemic supervening on venereal excoriations or sores, and *not* hospital gangrene. I shall advert to it hereafter, in speaking of chancre, or venereal ulcers.

The only cases that I have seen, with the slightest resemblance to hospital gangrene, were the sloughy stumps now and then occurring, perhaps more frequently during those years, formerly, when our wards were much troubled with erysipelas. The operation would either seem to be going on favourably for two or three days, the patient comfortable, and adhesion in progress, when a sudden change would set in, the stump become painful, swollen, hard, and red, the un-united part become sloughy, and the united part falling asunder, and soon also becoming sloughy; or, the stump never making any attempt at union, but soon becoming painful, swollen, and sloughy. In either case, the patient himself hot, dry, flushed, with brown tongue, and foul alvine discharges, the pulse quick, irritable, delirium and death supervening. I said such cases occurred, perhaps, more frequently when erysipelas was rife; but they really do happen when no erysipelas is in the ward at the time, nor has been for many months, and they occur not unfrequently in primary amputations in stout persons who have been accustomed to large quantities of beer or spirits, or of both, and from which they are not unfrequently entirely at once (and, as I consider, improperly) debarred; and hence, with a greater call than usual upon the powers of the constitution, are left to meet it with diminished means. Such cases are to be considered merely as resulting from want of power; but they are never epidemic or contagious, and must not be confounded with, hospital gangrene, which, however frequent it may be elsewhere, is, in London, at the present time, and has been for years, unknown by personal experience to most hospital surgeons.—J. F. S.]

36. The characteristic of hospital gangrene is its quick extension and the decomposition of the tissues without any special residue; if the grayish-white mass in certain cases be not so considered. Hospital gangrene is an extension of a wound or of a sore intermediate between ulceration and mortification.

37. The cause of hospital gangrene is the operation of a peculiar contagious matter, either upon wounds and the ulcerated parts or upon the whole body. The contagion develops itself usually in hospitals, where the air is deteriorated, many patients huddled together, and the bandages not kept clean; specially in unhealthy places, as gaols and so on. We know not how long the contagious matter may retain its activity. Probably the constitution of the atmosphere, the weather and climate influence the development and character of hospital gangrene. The susceptibility to contagion is not diminished by its having once been acted upon; on the contrary, it seems to have increased. The contact of the contagious matter with the wound is either the consequence of want of care in dressing it, its long exposure to the action of the air infected with contagion, or its having been covered with bandages in which the poison is retained. The contagion may happen to every person, and in every kind of wound and ulcer: it rarely, however, alters specific ulcers, whilst on the contrary a bilious constitution, mental affections, great feebleness, typhus fever, appear to be most favourable to it. The character of the disease itself may be changed by the constitution of the patient, and by the state of the weather; it may even become inflammatory, in which case the wound is encircled with a red ring, the pain is severe and throbbing, the pulse quick and hard, and the bleeding which occurs produces relief. Hospital gangrene is always a very dangerous complication of wounds and sores. Accidental circumstances may render the danger still greater; for instance, if it be impossible to give the patient

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(*a*) Medico-Chirurg. Trans., vol. xi. 1821.

attacked with the disease better air and better nursing, and so on. Left alone, hospital gangrene is usually fatal. If it have proceeded to a certain extent, art is rarely of any avail.

For the Literature of Hospital Gangrene, see p. 98.

38. After the appearances and terminations of inflammation, which have been described in general terms, we now come to those variations which inflammation may offer to our notice.

The existence of inflammation depends always on unnaturally raised vital processes: manifold circumstances, however, may change the appearances and course of inflammation, and these changes are only to be considered as modifications of simple inflammation; and the more so, the less they correspond to what we understand by increased vital action. The inflammation may be classed, 1st, *according to its appearances and course;* 2nd, *according to its causes;* 3rd, *according to the structure of the parts attacked.*

39. If the inflammation make its appearance with a certain intensity of its symptoms, and proceed rapidly, it is called *acute;* but, contrariwise, *chronic*, when the intensity of the symptoms is slight and their duration protracted, which condition may be either primitive or consecutive, depending on the constitutional condition. In regard to its character inflammation is further divided into *simple*, *erethitic*, *torpid*, *malignant*, and *obscure*. In *simple inflammation* all the symptoms of inflammation are present in a corresponding degree; it runs a speedy and most commonly satisfactory course; it is almost peculiar to strong persons, who have good health; its termination, if not resolution, is generally suppuration. The *erethitic* and *torpid* character of inflammation are merely modifications according to the *constitution of the patient* and the *degree of the inflammation*. In the *erethitic inflammation* the symptoms have not the same degree of severity as in simple inflammation; the sensibility is, however, distinctly increased, and it therefore especially appears in persons of delicate constitution. The *torpid inflammation* has a remarkably tedious course, and its symptoms seem to depend rather upon a local obstruction of the circulation in the capillary-vascular system than upon an accelerated vital activity; all the signs of active congestion are wanting, the part is not bright red, but dusky and brownish. It occurs specially in weak, reduced, cachectic subjects. Simple inflammation may also, under improper treatment, assume a torpid character. *Malignant inflammation* (*Inflammatio maligna, gangrænosa*) is often painless, or accompanied by an obtuse, heavy pain and dusky redness: its cause is sometimes manifest as the effect of deleterious or contagious matter; at other times, it is unknown: it supervenes on typhus and putrid fevers, and usually runs into gangrene. *Obscure inflammation* (*Inflammatio occulta, clandestina*) is that which is little or not at all indicated by symptoms.

40. Inflammation is divided, according to its different causes, into *idiopathic*, *symptomatic*, *specific*, and *sympathetic*. *Idiopathic inflammation* is the consequence of external violence; it exists as a local disease, and its severity is regulated by the degree of the injury and the condition of the subject. *Symptomatic inflammation*, at least the definite form under which it first appears, depends on internal causes, and the inflammation itself is to be considered only as a reflection of the general disease. If this be of a specific nature, as syphilis and so on, the inflam-

mation is said to be *specific*. *Sympathetic inflammation* is the consequence of a consensual change in the mutual relations which one part holds to another, by which their diseased affections become shared by both. The *metastatic inflammation* which passes from one organ to another is in close connexion with the sympathetic.

Symptomatic inflammation is either the original symptom of general disease, or an originally idiopathic inflammation acquires, through the general disease, a definite character.

41. In whatever part inflammation may occur, its peculiar seat is always in the *capillary-vascular* system. But its symptoms vary according to the different conditions of the affected part.

Inflammation of the *Skin*, if not severe, terminates in resolution with scaling of the cuticle, and not unfrequently also with dropsical swelling. In a more active inflammation a fluid is poured out beneath the cuticle producing vesications and pustules. If the inflammation be tedious without being active, the cuticle is destroyed; the fluid poured out by the exposed vascular net thickens into crusts. If the inflammation extend to the subjacent cellular tissue, it is generally severe and runs into suppuration.

Inflammation of the *Cellular Tissue* is usually accompanied with much ill-defined redness, with firm elastic swelling, much tension and throbbing pain; it does not resolve except it be in a mild form; its usual termination is suppuration, not unfrequently gangrenous destruction of the cellular tissue.

[This important affection of the cellular tissue, which has only within the last twenty years been particularly noticed, though commonly spoken of under the common title of erysipelas, is described more at length by our author, at page 103, "as a metastatic deposit in the cellular tissue, and one of the causes of his *Erythema symptomaticum seu consensuale*. Doubtless, it may be, and occasionally is, metastatic; but, generally it is idiopathic. It has of late years become common, and is a very rapid and dangerous disease, unless early and properly treated. Its importance is so great, that it is as fully entitled to a proper chapter as erysipelas, from which it most decidedly differs. But it will be, perhaps, more convenient to insert what I have to add where the subject comes under consideration in our author's arrangement, rather than to remove and drag his paragraphs into places for which he had not intended them, under pretence of making his meaning more clear, as if the author did not best understand his own view of the subject he discusses; a proceeding which has been occasionally practised in English translations, which I think cannot be too much deprecated, and the least inconvenience of which is, that it is not unfrequently impossible to refer from the original to the translation, or from the translation to the original.—J. F. S.]

Inflammation of the *Glands* mostly exhibits not very acute but rather dull pain, no great heat, very solid circumscribed swelling, which also extends itself into the surrounding parts. Its termination is similar to that of inflammation in the cellular tissue, except that glandular inflammation most commonly assumes a chronic character, and then easily passes into hardening.

In inflammation of the *Mucous Membranes*, their secretion is stopped at the onset; at the same time, increased warmth and sensibility, heavy pain and great redness make their appearance, a secretion of thin somewhat acrid fluid, the thickness of which increases, becomes creamy, and of perfectly mild character. No tissue so readily as the mucous membrane acquires a morbid disposition to inflammation. When affected with long-continued inflammation their spongy cellular tissue becomes loosened, swelled, thickened, and the vegetation on it often is so changed that new formations, polypous excrescences, are developed. In active inflammation, or in long-continued flow of mucus, ulceration and destruction of the underlying parts frequently occur. Very rarely do inflamed mucous membranes become adherent.

[In reference to the kind of inflammation which occurs in mucous membranes, HUNTER says:—"In internal canals, (I make a difference between an internal cavity and a canal; they are very different in their construction, their uses, and also their mode of action in disease are very different,) where adhesions in most cases would prove hurtful, the parts run immediately into the suppurative inflammation, the adhesive inflammation in common being excluded; such parts are the internal surface of the eyelids, nose, mouth, trachea, air-cells of the lungs, œsophagus, stomach, intestines, pelvis of the kidneys, ureters, bladder, urethra, uterus, vagina, and indeed all the ducts and outlets of the organs of secretion, which all these parts mentioned may be in some degree reckoned, and which are commonly called mucous membranes. In such parts, if the inflammation is but slight, the suppurative in common takes place, which is almost immediate, as it is not retarded by the adhesive stage, which accounts for the quickness of suppuration of these parts in many cases. * * * Since those surfaces are, in general, secreting surfaces, suppuration would appear to be only a change in the secretion; and I think I have visibly seen, or could visibly trace, the one change gradually leading into the other; the different parts, therefore, of which the pus is composed, will not always be in the same proportion, so that the matter will seem to vary from true matter towards that of the common secretion of the part, and *vice versâ*; but this does not alter the position, for it is common to matter from a sore, and even common to our ordinary secretions. If this inflammation which produced suppuration on those surfaces becomes more violent, or has something of the erysipelatous disposition, we find that it moves from the suppurative to the adhesive, and throws out the coagulating lymph." (p. 241, 2.)]

The *Serous Membranes* have great disposition to inflame; the inflammation is very painful, usually appears suddenly, spreads quickly, and easily passes into resolution, adhesion, transudation, and mortification, but rarely into ulceration. Serous membranes often thicken, either by the cellular tissue upon their external surface or by plastic membranes, or even in their own proper substance. Chronic inflammation of *serous membranes* appears mostly in the form of dropsical affections.

[Serous membranes are the circumscribed cavities which, with "the cellular membrane or the body in general," belong to the first order of parts into which the body is divided by HUNTER, and in relation to which he observes:—"When inflammation takes place in the first order of parts, it is commonly the adhesive; but it will be according to circumstances whether the suppurative or the ulcerative follows first." (p. 253.) "The adhesive inflammation serves as a check to the suppurative, by making parts which otherwise must infallibly fall into that state, previously unite, in order to prevent its access, as was described in the adhesive inflammation being limited; and, where it cannot produce this effect so as altogether to hinder the suppurative inflammation itself from taking place, it becomes, in most cases, a check upon the extent of it" (p. 365;) of which inflammations of the pleura, or surface of the lungs, presents a good example; "the adhesive inflammation takes place, and the surfaces are united, which union going before the suppurative confines it to certain limits, so that distinct abscesses are formed in this union of the parts; and the whole cavity of the thorax is not involved in a general suppuration." (p. 366.)

The peculiar disposition of serous membranes to assume in preference adhesive inflammation is remarkably contrasted with the equally special preference of mucous membranes for the suppurative inflammation. The construction of closed cavities by the serous, and of canals by the mucous membranes, afford the ready explanation of these peculiarities. Any opening, therefore, in a serous membrane puts it in an unnatural condition, and, consequently, if it were attacked with suppurative inflammation, the pus produced requiring an aperture for its escape, such unnatural state would be induced, and the functions of the membrane interfered with or destroyed: therefore, most commonly, adhesive is the kind of inflammation occurring, which only diminishes the cavity (the lesser evil) without opening it; and when, more rarely, suppurative inflammation ensues, it is most usually shut off from the general cavity by adhesive inflammation, as in spurious empyema; and only in few cases existing without such adhesion. Whilst, on the contrary, were mucous canals attacked with adhesive inflammation, they would be at once blocked up and the most dangerous consequences ensue, as occasionally observed in croup, and so on; but they prefer suppurative inflammation, and no such danger accrues.—J. F. S.

The inflammation of serous membranes sometimes runs on to suppuration. This was noticed by **Hunter**, who observes:—"In spontaneous suppurations, one, two, three, or more parts of the inflammation lose the power of resolution, and assume exactly the same disposition with those of an exposed surface, or a surface in contact with an extraneous body. If it is in the cellular membrane that this disposition takes place, or in the investing membranes of circumscribed cavities, their vessels now begin to alter their disposition and mode of action, and continue changing till they gradually form themselves to that state which fits them to form pus. * * * From hence it must appear that suppuration takes place upon those surfaces without a breach of solids or dissolution of parts, a circumstance not commonly allowed; and, when got beyond the adhesive state, they become similar in their suppuration to the inner surfaces of internal canals." (p. 378.)]

In inflammation of the *Fibrous Tissues* the pain is sometimes very severe, sometimes changeable, deep-seated, increased less by pressure than by the motions of the part, the warmth is much increased, the swelling, according to the difference in structure of the neighbouring parts, sometimes hard, sometimes soft, the redness slight, often scarcely discernible, but often far outspread. Its terminations are resolution, metathesis, gouty concretions, gangrene, and suppuration, which is confined to the cellular tissue connecting the fibres together, whereby a laminated arrangement is produced.

Inflammation of the coats of *Arteries* (1) is either generally diffused, with violent pulsation of the heart and arteries and high fever; or it is confined to one spot, when the symptoms are commonly obscure. The acute *partial* inflammation of arteries commonly runs into adhesion; the *chronic*, which mostly depends on diseases with little power, into thickening, loosening, ulceration, deposition of calcareous masses, whence (2) commonly results the origin of aneurisms.

[(1) Arteritis, as it is now generally called, is, probably, if idiopathic, an inflammation of the internal only, and not of all the coats of an artery, but, if traumatic, arising either from wound, from ligature, or more extensive pressure and the like, or if the inflammation have been communicated to the artery from neighbouring diseased parts then all the coats of the vessel become affected, and may pass through the various forms of inflammation. "The active and violent pulsations," says **Bouillaud** (*a*), which the arteries in the neighbourhood of a very acute whitlow perform are the type of those which characterize general arterial irritation. And he also observes, that there is besides the increased force of the arterial pulsations, a sensation of heat and uneasiness in the region which the inflamed artery occupies." (p. 411.)

Redness, thickening and friability are the appearances described as presented by the internal coat of an artery under acute inflammation; the redness and thickening from swelling of the membrane occurring simultaneously.

Hodgson (*b*) describes four cases, in the first of which the internal coat of the aorta was of deep red colour; a great effusion of lymph had taken place into its cavity, and become very intimately connected with the internal coat, and a plug of the lymph extending into the left sub-clavian artery nearly obliterated its cavity: these appearances accompanied a violent pneumonia. In three cases, viz. of carditis, pneumonia and bronchitis, he also saw it, but the effusion of lymph was less; in one case the aorta was throughout of a deep scarlet colour, and a little above the semi-lunar valves the coats of the aorta were distended with lymph. (p. 5.) He also quotes from **Portal** (*c*) a case of sudden subsidence of measles, in which "the aorta was throughout nearly its whole extent very red, and its walls swollen and soft, especially in the thoracic region, near the diaphragm, where it was covered with varicose vessels; the internal coat was swollen and softened." (p. 127.)

(*a*) Dictionnaire de Médecine et de Chirurgie Pratiques, vol. iii. Article *Artérite*.

(*b*) On the Diseases of Arteries and Veins, &c., London, 1815, 8vo.

(*c*) Anatomie Médicale, vol. iii. Paris, 1803. 8vo.

Redness, however, is not always present in an inflamed artery, and it often exists when there is not any inflammation, when putrefaction has commenced, in consequence of the blood transuding. And Bouillaud says:—"It is right to observe, that the redness of the internal membrane of arteries, even in the case where one is disposed to refer it to acute arteritis, is not produced, at least in the great majority of cases, by a *capillary injection*, but rather by a kind of *tinting* or *fixation* of the colouring matter of the blood on the internal membrane. Under this new point of view the inflammatory redness differs not essentially from that which is called *cadaveric*." (p. 403.) In inflammation of the whole thickness of the arterial walls, the outer coat is generally red, in consequence of the active and free injection of the numerous vessels which everywhere penetrate them; and sometimes there is even a slight infiltration of blood. Bouillaud further observes, that "after the internal coat, or even all the coats of an artery has been some time inflamed, it is easily detached in large flakes, the subjacent cellular tissue becoming friable." I apprehend, however, that what he considers as flakes of the internal coat are really deposits of adhesive matter upon the coat, and not portions of the coat itself. The result of acute arteritis is then deposit of adhesive matter, and, as already mentioned in one of Hodgson's cases, sometimes sufficient to fill up the tube of the artery, though, from the friction of the stream of blood upon the deposited lymph, Bouillaud considers that it is drawn into the stream, and that rather the "inflammation determines the coagulation of the blood circulating in the artery, and thus is easily explained how the secreted matter in addition to the mass of coagulum, may produce arterial obliteration." (p. 407.)

Adhesion of the lining membrane, and obliteration of the arterial tube, is one of the results of arteritis; but, as will be presently shown, the effusion of adhesive matter, and even the coagulation of the blood in the inflamed vessel, do not always cause mortification of the limb, as Dupuytren would seem to consider; that condition depending rather on the number of the vessels affected with inflammation, and the quickness with which the adhesive deposit takes place, so that the supply of blood is cut off before the collateral circulation can come into play. The usual consequences of inflamed artery are seen in the application of a ligature upon an artery, in which case generally the collateral circulation is speedily established and no inconvenience to the limb is sustained, whilst, on the other hand, occasionally the circulation is restored so slowly that mortification to greater or less extent ensues.

The following case of partial arteritis came under my own care, and for its previous history I am indebted to my intelligent friend Crisp of Walworth, whose patient he was.

Thomas Batt, aged 21½ years, a grocer's assistant, about five years prior to the present time, (August 1843,) had an attack of rheumatic fever which lasted six or seven weeks; and since has had several slight attacks of pleuritis, for one of which he was bled, but neither were so severe as to confine him to bed. The bellows sound was always heard over the region of the heart. On the *7th of August* he was seen on account of slight pain in the chest, for which he was ordered some aperient medicine with *vin. antim. potass tart.* The pulse at the left wrist was then felt and *nothing remarkable* observed.

August 9. A. M. Whilst putting on his waistcoat, he was struck with pain like the prick of a pin, about the middle of the left upper arm, and in the track of the brachial artery, which continued for about an hour, and during that time his arm "became dull and cold as low as the elbow." He saw his medical attendant at 10 A.M.; the arm and hand were then cold, and no pulsation could be felt below the arm-pit, at which part the artery was felt beating, but not forcibly, (90 a minute,) and over it great tenderness on pressure. The pulse of the right wrist was 100, and rather more powerful than usual. The ailing arm was ordered to be put in warm water for a quarter of an hour.

4½ P. M. In the same state as the morning; but has had five or six times a sensation of throbbing in the arm, with tingling and numbness of the fingers.

10 P.M. As he continued much the same, six leeches were applied to the arm-pit, and an opening draught given immediately.

August 10, A. M. Caustic was applied to the leech-bites, which had bled all night and were still bleeding, so that he felt rather faint from loss of blood; but the pulse of the right arm is not much affected. No pulsation in the left wrist; but the hand less cold than yesterday. There is great tenderness over the commencement of the brachial artery. ℞ *pulv. colchic.*, *pulv. antim.*, āā gr.v. *hydr. c. cretâ*, gr. x. *quintis horis sum.*

August 11. Much the same: the artery painful on pressure; the powders continued.

August 13. No change since the last report, except that the tenderness over the brachial artery is less and the hand not so cold. His bowels being confined, an aperient draught was ordered immediately, and the powders continued.

August 15. He came under my care at St. Thomas's, and, in addition to what has been already mentioned, he says, that he has long had a sense of weakness as if overworked, and that during the first day of the attack, the dullness and coldness continued extending down to the wrist, but unaccompanied with pain; that for the last two nights his arm has been affected with dull aching pain which has prevented his getting rest, but has subsided during the day. At present he is free from pain, except when the arm is bent or hanging down, under either of which conditions he has pain at the original spot in the middle of the arm. He has much tenderness on slight pressure from the middle of the arm upwards, and the arm-pit in the course of the artery, but none below. The pulsation in the brachial artery below the specially indicated part, is scarcely, if at all perceptible, and above it is slight; at the wrist, in the ulnary artery, there is not any pulsation, but the radial artery pulsates slightly. The pulse of the right wrist is distinct, full and quick. I ordered bleeding from the right arm to twelve ounces, milk diet, and *liq. ant. potass. tart.* ♏ x. *ex mist. potass. citr.* 4*tis*

August 16. He has been relieved by the bleeding; has less pain and more feeling in the arm.

August 17. A careful examination by the stethoscope indicates regurgitation through the aortic valves.

August 22. Complains of having had occasional shooting pain in the fore and middle fingers of the left hand, as if being cut off. No increase of pulsation at the wrist; the upper arm is less tender. He complains of having had pain in the sole of the left foot two days since, which yesterday extended into the great and second toe, so that he could not bend them without much pain; in course of the day the pain subsided at this part and attacked the dorsum pedis, where it yet remains, though less severe than yesterday.

September 5. Pulsation in the left radial artery is now very distinct though small.

September 26. On examination with the stethoscope, distinct bellows murmur with the second sound most decidedly over the aortic valves, and the first loud, short and clear: pulse jerking, regurgitation through the aortic valves, and dilatation of the heart.

October 4. The pulsation at the wrist still continues steady. He complains of having cough with expectoration and want of rest at night; is languid and thin, and his health not improving. ℞ *pil. opii. gr.* 1 *o. n.*, which was, on

October 24. Replaced with *tinct. camph. comp.* ʒj *ex mist. amygd. ter in die*, and, on

October 27. The opium was resumed. He has been gradually becoming more languid without any very distinct cause.

November 3. He spat a little blood, which continued increasing by degrees till

November 5. When he spat a large quantity, and died in the evening. During the last three days he has been so much exhausted, that it was absolutely necessary to keep him up with arrow-root and port wine four ounces daily.

Examination.—*Chest.* Some old pleuritic bands on the left side, but none on the right; the left pleural cavity containing a considerable quantity of serum.

Pericardium universally adherent; its free portion separated from the visceral with great difficulty. Heart enlarged; its apex wide and rounded: both ventricles enlarged; the walls of the left thickened, and those of the right somewhat thinned. Valves on the right side perfectly healthy. On the left the sigmoid valve of the aorta thickly beset or fringed with vegetations. The curtains of the mitral valve thickened and containing points of cartilage and bone. Both aortic and mitral orifices contracted, mainly dependent on the thickening of their individual valves.

Belly. Liver rather enlarged, dark-coloured, and in a state of hepatic venous congestion.

Left Arm. Brachial artery high upon the arm over a space of from half-an-inch to an inch, of a red colour, and its coats thickened, containing at this point a plug of coagulable lymph adherent on one side to the lining of the vessel. Below this part the vessel was much contracted to the extent of three or four inches, beyond which it again resumed its original calibre, and there the orifices of three or four minute vessels were perceived.

Adhesive matter may be deposited between the internal and middle coats of an artery, and even pus, of which an instance is mentioned by Andral. The internal coat of the aorta "was elevated by half-a-dozen little abscesses, each about the size of a hazel nut and situated between it and the middle coat; the pus contained in these abscesses resembled the usual pus of phlegmon." (p. 379.)

(2) The deposit of earthy matter in arteries generally involves only their coats, especially the inner coat; upon the exterior of which the earth is held to be deposited, in consequence of the thin internal coat being usually traceable and separable from it, so

that the earth is not in immediate contact with the stream of blood. This, however, is not always the case, for the lining coat sometimes appears to be deficient, or hangs in shreds into the tube of the artery, so that the blood does actually flow in contact with the earthy matter, and the latter is occasionally deposited in such quantities that it completely fills up the cavity of the artery, rendering it impervious, and converting it as it were into a calcareous rod, the particles of which, however, are not in very intimate union: an excellent instance of such conversion of the femoral artery is in the Museum of St. Thomas's Hospital.

The deposition of calcareous matter in the coats of arteries is not restricted to old persons; for **Portal** observes:—" The vessels of young persons rarely ossify; instances, however, have been noticed of ossifications in the arteries of some children, in whom the ossification of the bones had not proceeded far." (p. 133.) **Hodgson** also mentions, that " George Young possesses a temporal artery, which he removed from an infant of fifteen months old, in which the coats of the vessel are converted into a complete tube of calcareous matter." (p. 23.)

The analysis of the earthy concretions made by **Brande** for **Hodgson** presented 65.5 of phosphate of lime, and 34.5 of animal matter in 100 parts; the latter consisted chiefly of albumen, with traces only of gelatin. No carbonate of lime was discoverable.—J. F. S.

These earthy deposits are not bone as appears from the following statement of **Miescher** (*a*):—" Ossifications of all the arteries very frequently occur which are situated between the innermost and proper tunic, in form of larger and smaller plates, of which the smooth surface turned towards the cavity of the artery, the colour, density and toughness very closely resemble true bone; but, when broken, they always had to me a foliaceous or squamous appearance, very like the scales of an oyster-shell; nor could I ever, though often seeking with the microscope, discover corpuscles or canalicules; the soft substance left after the addition of hydrochloric acid never presented any definite texture." (p. 46.)]

Inflammation of the *Veins*, when partial, manifests itself by the symptoms of inflammation in general; but, when it spreads further and attacks the large venous trunks, then appear violent symptoms, such as a rapid pulse, depression, restlessness, delirium, and so on. The cause of inflammation of the veins is most commonly external injury. Its terminations are, 1st, thickening of the venous coats; 2nd, stagnation and formation of clots; 3rd, effusion of plastic lymph and obliteration; 4th, formation of pulsating swelling; 5th, suppuration and bursting of the venous walls; and, 6th, ossification.

According to **Cruveilhier** (*b*), the symptoms in adhesive phlebitis, as well as in circumscribed suppurative phlebitis, are entirely local, and originate in irritation of the internal coat of the vein, and in the mechanical obstruction, which, by stopping up the veins or the branches of the inflamed venous twigs, opposes the passage of the blood and of the lymph. The pain and fever depend on the inflammation, and the œdema upon the mechanical obstruction to the circulation. In the uncircumscribed suppurative phlebitis, the symptoms depend on infection of the blood. The patient passes suddenly and without intermission from a state not seemingly dangerous to stupor, prostration of power, and to death, like an animal into whose veins pus has been injected.

[Inflammation of the veins or phlebitis as it is now generally called is far from an infrequent disease, and when very active is extremely dangerous. As our author states, the cause of this disease is most commonly external injury; but I have known it to arise spontaneously in the leg, where the veins have had a varicose disposition. The track of the inflamed vein is easily distinguished by its redness, by its feeling like a cord of greater or less length beneath the skin, as thick and sometimes thicker than a goose-quill with protuberances at uncertain distances corresponding to the situation of the valves. This cordlike character depends upon the coagulation of the contained blood, " the coagulating lymph (fibrin) undergoing," as **Hunter** (*c*) observes, " some changes in its passage through the inflamed vessels, which obliges it to coagulate more immediately or much sooner than it would otherwise; for, in those cases of inflamed arms after bleeding, and in inflammations in consequence of other causes, we find that the cavities of the veins are in many places furred over and in others united by means of the coagulating lymph. Now, if this coagulating lymph is similar in its productions to that

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(*a*) De Inflammatione Ossium eorumque Anatome generali. Berolini, 1836. 4to.

(*b*) Anatomie Pathologique. Paris, 1837.

(*c*) On Inflammation, &c.

which we have been describing, it must have been thrown out from the vasa vasorum, these vessels having separated it and poured it into the cavity of the veins, and it must there have coagulated immediately: in this separation, therefore, from the blood, it must have undergone some change, arising from the action of the vessels; for, if this lymph was no more than the coagulating lymph, with its common properties, or the properties common to that which is circulating in the same vein which receives it, it would in such cases only continue to throw in more coagulating lymph, in addition to what was circulating, and therefore probably it would be carried along with the blood to the heart as a part of the common mass. From this we should infer that this coagulating matter is not simply the coagulating lymph such as it was when circulating, but somewhat different, from having undergone a change in its passage through the inflamed vessels, partaking of the disposition of those solids through which it passed. * * * But this may be taken up in another point of view, and upon the same principle; the inflamed vessels may give a disposition to the blood as it is moving slowly along, to coagulate on its surface, and this is probably the more just idea of the two; as we find that the vessels both veins and arteries can give this disposition, and to a very great extent: we find, in the begining of mortification, the blood coagulating in the vessels so as to fill them up entirely, and this, preceding the mortification, seems to be for the purpose of securing the vessel before it is to give way; we, therefore cannot doubt of a coagulating principle being given to the blood from the vessels." (pp. 311, 12.)

Accompanying the redness and cordlike feel there is more or less tenderness, and even actual and severe pain. The inflammation continues to extend towards the heart, presenting, as it proceeds, the same characters. Not unfrequently a chain of little abscesses take place generally at the protuberant valves, which burst of themselves, but are best laid open. The constitutional excitement varies considerably, sometimes is trifling, but sometimes very severe. With constitutional and local antiphilogistic treatment, leeching, fomenting and poulticing, the disease, however, is not unfrequently checked, the inflammation subsides, and the cordlike condition alone remains, which requires some time for its removal. If suppuration in form of little abscesses, as just mentioned, occur, the inflammation oftentimes ceases, and the case does well; but, if suppuration do not occur, then the disease becomes dangerous.—J. F. S.

Attention has long been drawn to the severe form of phlebitis; for, more than fifty years since HUNTER (*a*) observed that "in all cases where inflammation of veins rises high, or extends itself considerably, it is to be expected that the whole system will be affected. For the most part, the same kind of affection takes place which arises from other inflammations, with this exception that where no adhesions of the sides of the vein are formed, or where such adhesions are incomplete, pus passing into the circulation may add to the general disorder and even render it fatal." (p. 26.) And, having seen inflammation propagated along the jugular vein of horses into their chest, and followed by death, HUNTER says:—"But what is the particular circumstance which occasions their death I have not been able to determine; it may either be, that the inflammation extends itself to the heart, or that the matter secreted from the inside of the vein, passes along that tube in considerable quantity to the heart, and mixes with the blood." (p. 25.) This suggestion of HUNTER's was, without having seen a case, converted by ABERNETHY (*b*) into an actuality, when he ascribes the great sympathetic fever occuring in an extensively inflamed vein, not simply to the inflammatory excitement, but also "because irritation will be continued along the membranous lining of the vein to the heart." HODGSON (*c*) copies this statement of ABERNETHY's; for, in the single case of inflamed vein which he gives, he says distinctly, that "the vena cava superior was healthy. The diseased appearances were not gradually lost, but terminated abruptly; the heart was healthy;" whilst "the external jugular and the subclavian veins were filled with pus, and when slit open were found to be much thickened and lined with lymph." (p. 514.) He considers that "the constitutional irritation which is accompanied with symptoms of greater debility than acute inflammation in general, may probably arise from the extent of the inflamed surface, but that it is not unlikely it may be an effect produced upon the nervous system by the pus which is secreted into the vessel being mixed with the circulating blood." (p. 518.) CARMICHAEL (*d*) holds that the symptoms presented in phlebitis "were no doubt owing to the formation of

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(*a*) Observations on the Inflammation of the internal Coats of Veins; in Transactions of a Society for the Improvement of Medical and Surgical Knowledge, vol. i. London, 1798. 8vo.

(*b*) On the occasional Ill Consequences of Venesection; in his Surgical Works, vol. ii.

(*c*) As above.

(*d*) Observations on Varix and Varicose Inflammations; in Transactions of the King's and Queen's College of Physicians in Ireland, vol. ii. Dublin, 1818. 8vo.

matter, and the influence which it must produce on the general system when mixed with the mass of blood." (p. 368.) And Bouillaud (*a*) also ascribes the typhoid symptoms to the presence of pus in the system. Travers (*b*), however, does not agree with these writers as to the existence of pus being the cause of the symptoms. He first distinguishes between the inflammation which terminates in the formation of pus, and that which terminates in depositing adhesive matter or lymph, extends to the trunks of the system, and sometimes, it is said, reaching the heart: the former condition is a protracted irritation, causing hectic and ending in exhaustion; the latter a typhoid fever which, speedily producing delirium, terminates within a few days: cases of the first kind, though always dangerous, sometimes recover, but of the second, he believes, never. He then proceeds:—"There have been many conjectures respecting the cause of the fatal termination of these cases, at which I confess I feel surprised; among others, the inflammations, by extension, of the heart or the membranes of the brain and the conveyance of pus into the circulation have been mentioned. Not to insist on the innocuous quality of pus, it should be observed, that the most rapidly destructive inflammation is that which has the true adhesive progress, in which no pus is secreted. But, if we consider the importance of the veins in the economy, the extent of surface which the collective areæ of the venous trunks afford, larger, I imagine, than any of the shut sacs of the body, and the diffused and disorganizing character of the inflammation, we can surely be at no loss to account for the disturbance of the system. It is an error to suppose that any quicker sympathy exists between the constitution and the venous, than the arterial or absorbent system. I say this because I have observed something like that superstitious alarm which is excited by events that we do not expect, and cannot explain, has been produced by the fatal catalogue of tied veins, and a comparison of this with the generally successful cases of tied arteries. All the mystery of veins is, as I have attempted to show, that they are indisposed to inflame, but, when excited, inflame by continuity; and therefore it is that the constitution sympathises so deeply." (p. 286.) In a very excellent paper on phlebitis, Arnott (*c*) deduces from the collation of cases "the total disproval of the assertion, that death results from the extension of the inflammation of the vein to the heart." In none of the ten instances following venesection was the superior cava affected, much less the heart; and, in half this number, inflammation had not reached to the subclavian or even to the axillary vein. In the cases where the inferior cava had become inflamed, the first is the only one in which the heart is represented to have been actually implicated; and here, the deposition of lymph terminating at the entrance of the emulgent vein, the observation is, that there were marks of diffused inflammation extending to the right auricle of the heart, but the signs of adhesive inflammation terminated as above." * * * With the exception of the instance just alluded to, I have only found two others in which it is alleged that the inflammation had extended from the vein to the heart, and in these the description is not very precise. Both cases are mentioned by Ribes (*d*). In one, occurring so far back as the year 1799, where the veins of the arm were inflamed in connexion with gangrene of the hand from chilblain, "traces of inflammation" are stated to have been continued into the superior cava, and even to the interior of the right auricle and ventricle; and, in the other instance, where the saphena evinced some signs of inflammation, in a case of mortification of the leg and foot, it is stated, in the same vague terms, that "the right auricle and ventricle of the heart, as well as the inferior cava at its insertion into this organ, had manifest traces of recent inflammation." It is to be regretted that Ribes has not distinctly specified what the "traces" were which he considered as indicative of inflammation in the lining membrane of the heart. (p. 42, 43.) From Arnott's statement, it appears further that "there are considerable differences in the extent of vein occupied by inflammation in fatal cases of phlebitis. Sometimes the disease has spread into several or most of the veins of a limb from that primarily affected; at others it has not proceeded beyond the vessel in which it originally appeared," sometimes is "limited to a few inches only of a vein," and thus "justifies the inference that the dangerous consequences from phlebitis bear no direct relation to the extent of the vein which is inflamed." (p. 44.) As regards the contents of the inflamed vessels, "in a number of them, where an open wound existed in the vein, pus was discharged from it during life; whilst in fourteen cases out of seventeen, pus, or pus in conjunction with lymph, was present in the vessel after death.

(*a*) Recherches Cliniques pour servir à l'Histoire de la Phlébite; in Revue Médicale, June. 1824.

(*b*) Essay on Wounds and Ligatures of Veins; in Cooper and Travers's Surgical Essays, vol. i. 3d Edition. London, 1818. 8vo.

(*c*) A Pathological Inquiry into the Secondary Effects of Inflammation of the Veins; in Medico-Chirurg. Trans., vol. xv. 1829.

(*d*) Revue Médicale for July, 1825.

In two instances, no mention is made of pus, the contents of the veins being described in the one as "adhesive matter," in the other, where the cava was concerned, as "flakes of lymph." In one case only, where the inflammation occurred in a vein previously diseased, or in a vein, the branches of which at least were varicose, neither pus nor lymph was found in the vessel. "It results from this statement, that, although pus is present in the great majority of fatal cases of phlebitis, and that, although it should appear from the character of the general symptoms, and the effects produced upon animals by the injection of a similar fluid into their vessels, the passage of pus into the circulation is probably the principal, yet the circumstances do not justify us in regarding it as the sole, cause of the secondary affection. In addition to the presumed absence of pus in two instances, and its declared absence in a third, it may be remarked that the early appearance of the symptoms in some cases seems scarcely to correspond with the time usually required for the production of pus, as in one which occurred to **Freer**, (quoted by **Hodgson**, p. 551,) where they came on suddenly, four hours after ligature of the saphena." (pp. 44, 45.)

"The secondary affection in phlebitis usually shows itself in from two to ten or twelve days after the receipt of the injury which has occasioned the inflammation in the vein; where the vessel has been previously diseased, sometimes sooner. * * * The duration of this affection offers some variety," (pp. 51, 53,) death taking place at different periods from the fourth day to the end of the seventh week. The remarkable morbid appearances recited by **Arnott** are, "in the chest, effusions of sero-purulent fluid into the cavities of the pleura and pericardium, exudation of coagulable lymph on the surfaces of the heart and lungs, hepatisation of the latter organ, infiltration of pus into its tissue, or small collections like a mixture of pus and lymph, pus also in the muscular substance of the heart. * * * In the cellular substance, intermuscular as well as subcutaneous, pus and sero-purulent fluid have been extensively deposited, sometimes in collections like abscesses, at others, appearing more like an effusion into its cells than as resulting from the common process of inflammation. These collections more frequently occur in the vicinity of joints. * * * In the joints, a most violent inflammation of the synovial membrane, its distension with purulent matter, destruction of the cartilage and baring of the bones. * * * In the eye, opacity of the cornea, injection of its blood-vessels, and destructive changes in its humours or its coats. Besides these affections, there were found in five instances within the cranium opacity and thickening of the tunica arachnoides, effusion between it and the pia mater, and increased secretion into the ventricles. In nine the head was not examined, and in three no morbid appearances were noticed." (pp. 53, 57.) The conclusion at which **Arnott** arives is, "that death in cases of phlebitis does not take place from the inflammation extending to the heart; whilst the history and character of the symptoms which precede this event, the very small portion of vein which is sometimes found to have been inflamed, and the general presence of pus in its cavity, all tend to establish, that the entrance of this fluid into the circulation is the principal cause of the alarming and fatal consequences of phlebitis, a similar influence being perhaps also possessed by any inflammatory secretion from the vein." (p. 61.)

On the inflammation of the femoral and iliac veins, which occurs in puerperal women, which sometimes, but not always, gives rise to *Phlegmasia dolens*, Dr. **Robert Lee** (*a*) observes, that, "whether the inflammation of the coats of the veins be simple adhesive inflammation, or inflammation of a specific kind connected with the puerperal state, and differing, not only in the degree of intensity, but in its essential nature from phlebitis after venesection, it is difficult to determine. The peculiar character of the symptoms seems strongly to favour the latter opinion, though it cannot be denied that the disease occasionally assumes the form of common phlebitis, fatal cases having occurred where pus has been found secreted by the internal coats of the iliac veins, and death caused by inflammation and apostematous deposits of matter in the lungs and other remote organs of the body." (p. 145.)]

In the *Absorbent Vessels*, inflammation arises either from external injuries and so on, or from some morbid matter which they have taken up. It is indicated by painful red swelling of the absorbent vessels up to the nearest gland. It usually terminates in resolution.

[Inflammation of the absorbent vessels may arise without either injury or the absorption of morbid matter, but simply from irritation, as frequently seen in whitlow or other inflamed condition of the fingers or toes, as when they have been chafed or after the

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(*a*) On the Pathology of Phlegmasia dolens; in Medico-Chirurg. Trans. vol. xv. 1829.

application of a blister. The red streak or streaks which indicate the inflamed absorbent vessel or vessels, is generally little thicker than a stout thread, pale towards its edges, can at first scarcely be called a swelling, but is more like a streak of paint on the skin, and only after some time has a slightly knotted feel. It runs along the limb with great rapidity, and will in the course of a few hours enter the cavities of the trunk. It terminates in suppuration less frequently and less quickly than inflammation of the veins. Generally it subsides as the irritation which has excited it is relieved, and I do not remember to have observed continuance of the cordlike feel long after the inflammation has ceased —J. F. S.

In reference to these red streaks, HUNTER observes:—" These reddish streaks are supposed to be absorbents, becoming inflamed by their carrying a stimulating fluid. I am apt to suppose them to be absorbents; but I do not conceive that this effect arises from absorption. If it arose from such a cause, it should be uniform; the cause should always exist when the effect takes place. It is first to be observed that it only takes place in certain constitutions, in which absorption one way or other explains nothing; and I find upon observation that this effect shall be coeval with the inflammation where no suppuration has taken place. I have even seen it arise from accident, prior to the possibility of inflammation taking place, viz., in the time of the pain arising from the immediate effects of the accident; this was in the finger, from the prick of a clean needle, which had been for some time pricking new buckskin leather; the glands in the arm-pit were sore, sickness attended with its usual symptoms, such as oppression, was nearly immediate. Its direction from the source of the circulation is another strong proof of its not arising from absorption, and its taking place at some distance is also a corroboration of the same opinion. Another strong circumstance in favour of this opinion is, that the morbid poisons do not produce this effect where we know absorption has taken place. Thus the venereal seldom or never produces it." (p. 275.)

I have seen earthy deposits in the absorbent vessels of the skin, and also of the spermatic cord, giving them the appearance of corallines.—J. F. S.]

Inflammation of *Nerves* or rather of their sheaths is no very rare circumstance. As the nerves have but few nutritive vessels, the usual symptoms of inflammation, viz., heat, redness, and swelling, are present only in a slight degree. It begins with formication, torpor, frequently with severe darting pain, which spreads in paroxysms, like electric shocks, along the branches of the nerves; and to these are added febrile excitement, cramps, and convulsions. The inflammation may have either a *chronic* or *acute* course; the former we observe in *ischias nervosa* and many neuralgies, the latter in *tetanus*, *hydrophobia*, and so on. On examination we find the nervous sheaths especially affected, reddened, swollen; the nervous matter is frequently dissolved, as if grangrenous; often there are produced exudations in the nervous sheaths, or degeneration of the nerves.

Inflammation in the *Bones* occurs either in the periosteum or in the medullary membrane, or in the substance of the bone itself. In all these cases the symptoms are different, especially according to the acute or chronic course of the inflammation. In inflammation of the *Periosteum*, (*Periostitis*,) a circumscribed swelling with more or less acute pain is produced by exudation between the bone and the periosteum. If the inflammation do not resolve, it runs on to hardening, gouty thickening, exostosis, into caries, necrosis, and more rarely into fungous degeneration. Inflammation of the *Medullary Membrane* is characterized by deep-seated, gnawing pain, at last the bone itself swells throughout its whole thickness; and, if the inflammation do not resolve, it runs on to closing up of the medullary canal, or suppuration and destruction of the bone from within outwards, in necrosis or fungous degeneration. In inflammation of the *Bone* itself thickening throughout its whole extent (*Hypertrophy*) may occur, with closing of the medullary hole, ulceration, necrosis, and different kinds of degeneration of the bony tissue.

42. The *Prognosis* of inflammation is very various ; it depends specially on its severity and character, on its causes, on the constitution of the subject, and on the parts in which it is situated.

43. The *Treatment* of inflammation generally purposes to effect its resolution, except in certain critical inflammations, in wounds with much contusion, and in furuncles.

The first indication is the removal of the cause, if it continue to operate. If the inflammation be not very great, this alone is often sufficient. If the cause cannot be removed, or the inflammation have advanced to a certain extent, the plan of treatment includes all the means which are implied in the term antiphlogistic mode of cure. In those inflammations which are connected with much fever we must employ bleeding, nitrate of potash, and other antiphlogistic remedies, with cooling diet and rest. If the inflammatory symptoms are thereby diminished, calomel is specially useful to hasten the absorption of the lymph effused into the cellular tissue, and to prevent its coagulation. If the inflammation have an erethitic character, if it be accompanied with greatly increased sensibility, we endeavour after the above-mentioned antiphlogistic treatment to lessen it by opium in connexion with proper antiphlogistic means, such as mercury, hyoscyamus, and hydrocyanic acid, laurel water, and so on. If gastric impurities exist, they must be removed by vomiting and purging. In malignant inflammation the treatment must particularly depend on the kind of accompanying fever; the antiphlogistic treatment is then to be used only with circumspection. If the inflammation have a specific character, if it be connected with a dyscratic affection, we must act according to the degree of the inflammatory reaction, first on the antiphlogistic plan and then against the dyscracy : the antiphlogistic treatment, however, in this case, requires to be pursued with moderation.

[JOHN HUNTER, in treating "of the methods of resolution by constitutional means," makes many very excellent remarks on blood-letting, the object of which, as just mentioned, is to produce the contraction of the vessels, and which is always to go "hand in hand" with the soothing or lessening irritability, or the action of dilatation, by means of sedatives, relaxants, and stimulants, sudorifics, &c. Neither of these proceedings "can possibly lessen the original inflammatory disposition :" they may, however, "in some sense be reckoned direct; for, whatever will produce the action of contraction in the vessels, is counteracting the action of the dilatation. Lessening the power of action belonging to any disposition can only lessen or protract the effects, which, however will be of singular service, as less mischief will be done, and it will often give the disposition time to wear itself out. Means employed on this principle, should be such as give the feel of weakness to the constitution; which will affect the part, and will make the vessels contract; but this practice should not be carried so far as to produce the sense of too much weakness, for then the heart acts with great force and the arteries dilate. Bleeding, then, as a general principle, is to be put in practice: but this must be done with judgment; for I conceive the effects of bleeding to be very extensive. Besides the loss of any quantity of blood being felt, in proportion to the quantity lost, an universal alarm is excited, and a greater contraction of the vessels ensues, than simply in proportion to this quantity, in consequence as it would appear of a sympathetic affection with the part bleeding.

"As many patients that seem to require bleeding have been already bled, it may not be improper to inquire how they bear or are affected by bleeding; for, certainly, all constitutions (independently of every other circumstance) do not bear this evacuation equally, and it is probable, that its effects on inflammation may be nearly in the same proportion; if so, it becomes a very useful caution; for, although the loss of blood may as a general principle be set down as a weakener, and probably the greatest, as we can kill by such means, yet the loss of certain quantities in many constitutions is necessary for health; this is either when there is a disposition to make too much blood, or a constitution that cannot bear the usual quantity; in such, when known, bleeding with freedom is certainly necessary. * * * * * * Every part of the body under inflammation will not bear bleeding alike. I believe that the constitution bears bleeding best when the inflammation is in parts not vital, and those near the source of the circulation: whatever disturbs some of the vital parts, depresses, but not equally in all; and in them it becomes more necessary to be particular, for, in accidents of the brain, bleeding freely, even so as to produce sickness and fainting, is necessary. It is probable that the sickness attending such accidents, is designed to lessen the influx to the head, and occasion the vessels of the brain to contract." (pp. 335, 7.)

"With regard to this evacuation," (blood-letting,) he observes further, "it is worthy of particular consideration, whether or not in all cases, where it can be put in practice, bleeding in or near the part will answer better than taking the blood from the general habit; for certainly less may be removed in this way, so as to have equal effect upon the part inflamed, (and probably upon every disease that is relieved by bleeding,) and yet affect the constitution less; for, although, in many cases, the general habit may be relieved by bleeding, yet the part affected, where it can act, will in all cases require this evacuation most, and local bleeding will keep nearer these proportions, whereas taking blood from the general system is just the reverse. * * * I have observed that there is something similar to sympathetic affection in bleeding. I conceive that all the sympathetic powers, the universal, continued and contiguous, may be brought into action from the local influence of bleeding. Thus, bleeding in the part inflamed, I can conceive, does more than simply emptying the vessels mechanically, for that would soon be restored from the general circulation; but it acts by continued sympathy, viz., the vessels of the part being opened, they contract for their own defence, and this is carried further among the vessels of the part; so that bleeding from the part acts in two ways, viz., mechanically by relieving the vessels of some blood, so as to allow them to contract in proportion as the load is taken off, and also to excite them to contraction in order to prevent the effusion of blood. I suppose, likewise, that contiguous sympathy comes into action; for this would appear from practice and observation to be a principle in bleeding: therefore, in inflammation of contiguous parts it is proper to bleed from the skin opposite to them." (pp. 338, 9.)

"Where the first indication for bleeding takes place, viz., where there is violent inflammation, with strength of constitution, bleeding freely will be of singular service. * * * As it seldom happens that bleeding once will be sufficient in a considerable inflammation, the first or preceding blood taken becomes a symptom of the disease. * * * On the other hand, there may be indications for bleeding sparingly; first, when there is too much action with weakened powers; secondly, when there is a disposition to form but little blood; thirdly, when the part affected is far from the source of the circulation. From the above three dispositions that require bleeding sparingly or with caution, I may observe, that it will most probably be proper in all such cases to bleed from, or as near, the part affected as possible, in order to have the greatest effect with the loss of the least quantity of blood, more so than when the constitution is strong, because the constitution in such cases should feel the loss of blood as little as possible. * * * But in many cases the blood cannot be taken away from the part itself, but only from some neighbouring part, so as to affect the part inflamed." (pp. 339, 40.)

"Bleeding should in all cases be performed with great caution, more particularly at first; and no more taken than appears to be really necessary; it should only be done to ease the constitution, or the part, and rather lower it where the constitution can bear it; but, if the constitution is already below or brought below a certain point, or gives the signs of it from the situation of the disease, then an irritable habit takes place, which is an increased disposition to act without the power to act with. This of itself becomes a cause of the continuance of the original disposition, and therefore will admit neither of resolution nor suppuration, but continue in a state of inflammation, which is a much worse disease than the former." (p. 344.)

44. Different as is the *General* treatment of Inflammation, no less so is the *Local*. The local means are, *abstraction of blood*, *cold*, *moist*, or *dry warmth*, *salves* and *plasters*, *astringent*, *anodyne* and *derivative means.*

["Wherever," says John Hunter, "there has been a violence committed, or some violent action is going on, there is a greater influx of blood to that part. Lessening therefore that influx becomes one mode of relief; for, as the vessels dilate, they should not be encouraged in that action. Although the increased influx is to be considered chiefly as an effect, yet it is to be considered as a secondary cause; and, from our ignorance of the immediate cause, it is probably only through such secondary causes that we can produce any effect; and upon these principles most likely rests, in some measure, the method of resolution; for, whatever will lessen the power and disposition will also lessen the effect; and possibly these will likewise lessen the force of the circulation. If the inflammation is attended with considerable action and power, as it were increasing itself, then the modes of resolution are to be put in practice; the one by producing a contraction of the vessels, the other by soothing or lessening irritability, or the action of dilatation. The first, or contraction of the vessels, is produced in two ways; one by producing weakness, for weakness excites the action of contraction of the vessels; the other by such applications as induce the vessels to contract." (p. 335.)]

45. *Local Bleeding* is more indicated as the inflammation is more simple and active, the redness and swelling greater. Every local blood-letting is connected with a certain degree of irritation which may at once reproduce an increased influx of blood. This is the more certain when general plethora is present. It is therefore necessary in many cases to employ general previously to local bleeding. Local blood-letting is performed by *leeches*, *scarifications*, and *cupping-glasses*. Leeches are most commonly employed; scarifications are restricted to those cases in which the application of leeches is not possible, as, in the mouth, on the tongue, in the throat, on the conjunctiva. Cupping is more especially suited to lingering and deep-seated inflammations, inasmuch as, besides the abstraction of blood, it also operates as a powerful derivative on the surface.

46. The employment of *cold* by the overlaying of cloths dipped in cold water, in water and vinegar, in water cooled by the solution of different salts, in solutions of acetate of lead or sulphate of zinc, the application of ice and snow, is only indicated at the commencent of idiopathic inflammation, when but little swelling has taken place. These means must always be preserved at the same degree of cold. They are specially active in inflammations caused by severe bruises, lacerations, and so on, when there is accompanying weakness of the vessels, and their effect may then be still more increased by the addition of spirituous remedies; for example, brandy, THEDEN's arquebusade, and so on.

[In using ice or freezing mixtures, care must be taken, lest, by their too long continuance, the vitality of the part is destroyed, and sloughing of the skin produced, which has occasionally happened.—J.F.S.]

47. *Moist warm remedies* are employed in shape of fomentations and poultices, which are made of mucilaginous or mealy substances, from linseed-meal, bread crumbs, oatmeal, bran, marshmallow leaves, emollient herbs boiled with water or milk put into linen bags and laid in such way as at once to cover the whole neighbourhood of the inflamed part. Poultices are preferable to fomentations, as their warmth is retained longer, and they need less frequent renewal. Fomentations are therefore only employed in cases where the part is so sensitive that it cannot bear the pressure of the poultice; they must also extend over the whole neighbourhood of the inflamed part, and be covered with a dry towel or flannel by which the heat is longer retained. These remedies are especially applicable to large swellings and painful tensions, as, by their relaxing properties, they diminish the resistance of the cellular tissue. If the tension be less, the poultice may be moistened with lead wash. Many inflammations, as gouty and erysipelatous, do not consort with the employment of moist remedies, but only with *dry warmth*. When the pain is very severe, narcotics, as the fresh hyoscyamus, belladonna, and so on, may be added to the poultices. With these moist warm remedies are usually also employed the

infriction of emollient salves, especially mercurial ointment, in order to further resolution by hastening the absorption.

[" Fomentations, or steams, washes, and poultices," says HUNTER, "are the common applications to a part in the state of inflammation. The first and last are commonly applied to inflammation arising from external violence and proceeding to suppuration; the second commonly to internal surfaces, as the mouth, nose, urethra, vagina, rectum, &c. The action of the first two is but of short duration.

"Fomentations and steams are fluid bodies raised into vapour: they may be either simple or compound; simple, as steam or vapour of water, compound as steam of water impregnated with medicine. * * * * Washes are in general fluid applications, and are more commonly applied to inflammations of internal surfaces, than of the common integuments: there are washes to the eye, called collyria; washes to the mouth and throat, called gargles; washes to the urethra, called injections, and to the rectum, called clysters. * * * These applications, like fomentations, are of short duration, for there is no possibility of applying these powers constantly, except in the form of a poultice, whose operation is somewhat similar, and indeed they are only substitutes for a poultice, where that mode of application cannot be made use of, as I observed with respect to internal surfaces.

"Poultices are constant applications, and like fomentations may be of two kinds, either simply warm and wet or medicated. The greatest effect that a poultice can produce must be immediate; but its power will extend beyond the surface of contact, although only in a secondary degree.

"To the common inflammation, the simplest poultice is supposed to be the best, and that effect I believe is only by keeping the parts easier under the complaint; but I am of opinion that such do not affect the inflammation any other way. A common poultice is, perhaps one of the best applications when we mean to do nothing but to allow nature to perform the cure with much as ease to herself as possible. Poultices may be medicated so as to be adapted to the kind of inflammation." (pp. 361, 362.)

ABERNETHY's observation that "poultices are blessings or curses as they are well or ill made, and that more commonly they only irritate instead of doing good," though it may excite a smile, is borne out by daily observation; for, instead of the highly sensitive surface of an inflamed part being soothed, as it should be by the application of a poultice, "the three properties of which are," to use that excellent teacher's words, "that it should be perfectly soft, perfectly smooth, and perfectly moist," it is too frequently irritated by loading with a heap of hard and lumpy materials which soon dry, and almost as soon become sour.

The *bread and water poultice* is the best, and in general most suited for all circumstances, either as a simple application, or as a vehicle for the employment of the juices of substances which in themselves are too harsh to be applied to very sensitive parts. To make this poultice, ABERNETHY directs:—" Scald out a basin (for you can never make a good poultice unless you have perfectly boiling water) and put boiling water in it; throw in some coarsely crumbled bread crumbs, and cover it up with a plate. When as much water has been soaked up as the bread will imbibe, drain off the rest, and a light pulp (not to be beaten into paste, as usually done, but merely broken with the edge of a fork) is then left, which is to be spread, the third of an inch thick, on folded linen, and applied at the temperature of a warm bath." If it be advisable to medicate the poultice, the juice of fresh hemlock, decoction of carrot, or opium, or any other material in solution, may be added to the sodden bread after it has been well drained; and thus is formed a very soothing application. It is best not to add lard or grease of any kind to a bread poultice, as thereby its relaxing effect on the skin is diminished or destroyed. But as, if left exposed to the air, it soon cools, dries, gets hard, and becomes uncomfortable and irritating, it must be either continually moistened by dropping on it, from a sponge, warm water or the warm medicated solution through the linen, without removing it from the part to which it is applied, and under which circumstances it acts to a certain extent by evaporation, diminishing the increased external heat, and lessening the action of the vessels, though the warmth of the water prevents its reduction to coldness. But, if suppuration have set in and it is necessary to keep up the warmth, then the cloth containing the poultice must be enveloped in a piece of oiled silk, which retains the moisture, and be overlapped with flannel, which preserves the warmth. Milk is often used instead of water for making poultices; but, if the skin be unbroken, water is preferable. No poultice should be boiled, as it is merely converted into paste.

The *linseed-meal poultice* is to be made like the former, by throwing the meal into perfectly boiling water; but it requires well beating to remove all the lumps, and is then to be spread a quarter of an inch thick on linen. It is not a good application for *inflamed parts on account of its weight, and, indeeed, under any circumstances, it is best if made with an equal quantity of bread crumbs.—MS. Notes of Lectures.*

In cases where warmth is most agreeable to the patient's feelings, and in which fomentations are employed, either because thin flannel dipped in them is lighter than the poultice, or because the surface to be covered is so large that a flannel is most convenient, the moisture and warmth are easily preserved by enveloping the overlaying flannel with oiled silk; this treatment has also the advantage of not so repeatedly disturbing the patient as the flannels alone do.—J. F. S.]

48. In the *Torpid* inflammation this character may show itself from the first or during its progress: when the expansion is more passive, and the vessels over distended, with diminished reaction, the congestion of the vessels must first be relieved by local blood-letting, and then the vital activity must be aroused by exciting remedies; by the momentary use of cold, by overlaying with watery or vinous infusions of aromatic herbs, by warm applications of lead wash or THEDEN's arquebusade, by infriction of volatile salves, of mercurial ointment with camphor, by the application of irritating plaisters, of ammoniacum plaister, which we specially use at night, because the applications very readily cool. With these local remedies a corresponding general treatment according to circumstances must be coupled.

The local and general use of stimulating and irritating remedies in many cases of inflammation is not contradictory to the above-mentioned conditions, and does not mislead to the recognition of the so-called *asthenic inflammations.* There is no inflammation depending on weakness; certain states of disease may, however, co-exist with inflammation, or be produced by the consumption of vital activity, caused by the inflammation, by the removal of which alone a cure of the inflammation is possible.

49. The *derivative remedies* are founded on the law of reciprocal action in our constitution; by which means an existing irritation may be lessened or removed by a more severe one. To this class belong blisters, setons, issues, and the rubbing-in of irritating salves. In general these are only to be used when the severity of the inflammation has been moderated by the preceding treatment; they are particularly useful in chronic inflammation.

In how far this general mode of treating inflammation must be modified according to the difference of the structure affected, will be subsequently considered in many places.

["Derivation" says HUNTER, "means a cessation of action in one part, in consequence of an action having taken place in another: and when this is a cessation of a diseased action, then a cure of that action in the original part may be said to be performed: this cure was brought into use from the idea of humors; that is, the drawing off of the humors from the seat where they had taken possession: but I believe much more has been ascribed to it than it deserves. How far it really takes place, I have not been able fully to ascertain in all its parts; that is, how far the real disease has been invited, and accepts of the invitation: but I have already observed that there is such a principle of disease in the animal economy, although we must see from derivation, that the same quantity or perhaps more irritation is retained in the constitution; yet the artificial irritation produced being either such as more readily admits of a cure than the diseased part, or being in parts which are not so essential to life, an advantage by this means is gained." (p. 359.)]

50. If the inflammation have a disposition to recede, every thing must be removed from the inflamed part which can disturb the proper development of the inflammation and favour its recession. The inflamed part must be covered with warm flannel, it must be protected from the approach of the air, and medicines given internally which will act on the skin. If the inflammation have already subsided from the external surface, we must

endeavour to bring it back by mustard plasters, blisters, and cauteries; it must be treated generally according to the severity and character of the inflammation.

51. If the inflammation have run on to exudation, and inflammatory symptoms still remain, antiphlogistic neutral salts must be employed, especially bitartrate of potash; but, if accompanied with weakness and inactivity of the absorbents, then exciting remedies and such as act upon the kidneys must be used, as mercury, squills, digitalis, senega, and so on. If the accumulation be so great that it interferes with the active functions of important viscera, or cannot be removed by the methods already proposed, the fluid must be discharged by opening the cavity in which it is contained. In œdematous swelling of the cellular tissue, bags of warm aromatic herbs, mingled with camphor, must be used; in torpid subjects, flannel fumigated with mastic and amber, and a moderate compression by means of bandages may be employed.

52. If the symptoms described (*par.* 10) indicate a transition of the inflammation to suppuration, nature must be assisted in this process. In strong persons, and with a certain degree of inflammation, suppuration in general is effected without difficulty, and it is sufficient to employ a less active general treatment, emollient fomentations and poultices. If the pain be more severe, narcotic poultices may be used; and, in decided hardness and inflammation, even blood-letting. But if, on account of the weakness of the constitution, or the torpid character of the inflammation, the formation of pus is tedious, it must be assisted by stimulating remedies; roasted onions, yeast, must be mixed with the poultices and applied warm. The diseased parts must be covered with rye flour and honey, with *emplast. de cicutâ c. ammoniaco, emp. galb., emp. diachylon comp.* All these, however, may be dispensed with by the suitable and constant application of warm lotions and poultices.

53. When under this treatment of abscess its *ripening* has taken place, that is, if about its circumference hardness is no longer to be felt, it either opens of itself or it must be opened. Only in small abscesses just beneath the skin, and in those in glandular structures, may the opening be left to nature (1). The early opening of abscesses is not unfrequently required, and specially under the following circumstances: 1. if in sensitive parts severe pain arises from the collection of pus, and the tissue of the part is thereby rendered tough and unyielding; 2. if the pus be collected beneath muscles and firm aponeuroses, in which case its burrowing is to be dreaded; 3. in abscesses in the neighbourhood of important organs surrounded with loose cellular tissue; for instance, abscesses in the neighbourhood of the rectum, or in the neck, where the pus may spread to the collar-bones; 4. in abscesses on the joints, or in the neighbourhood of other cavities, where, however, bursting into these cavities is not so much to be feared as the symptoms resulting from the pressure of the pus; 5. if the suppuration be near a bone or a tendon; 6. if by long continuance of the inflammation the cellular tissue beneath the skin be destroyed to a considerable extent; 7. and in critical abscess.

Abscesses in the neighbourhood of important parts are generally opened rather late, because in a large collection of pus the elevation of the skin ensures against any injury to deep-seated parts.

[(1) This is not good practice; abscesses just beneath the skin should always be punctured early, as otherwise there is great risk of sloughing of the integument and the formation of an ugly scar. Neither should abscesses in glands be left to burst, which is often a very tedious process, as the capsule of the gland does not readily ulcerate, and will not till the whole, or nearly the whole, gland is destroyed; a large cavity is thus formed, which is generally very difficult to heal, as it assumes oftentimes a fistulous character. It is therefore always best to puncture a glandular abscess as soon as the capsule and the skin have become adherent, and the angry appearance of the latter indicates its disposition to ulcerate. But it is not unfrequently advisable to open such abscesses before the skin reddens, or even before it is adherent; for, in scrofulous and chronic abscesses, there is often little and sometimes no redness of the skin, and yet, the collection of pus increasing, the skin becomes stretched beyond endurance, and sloughing ensues.—J. F. S.]

54. The *opening of abscesses (Oncotomia)* is effected either by a *cutting instrument*, by *escharotics*, or by *seton*. That point is preferred for opening where the fluctuation is most distinct and the skin thinnest; but, if the skin is everywhere equally thin, then the lowest part is preferred. The size of the opening depends on the extent of the abscess, and should always be such that the pus will flow without hinderance. An aperture of five to eight lines long is generally sufficient; an opening of an inch and a half must be the extreme for an abscess of large size. It must be recollected, however, that the skin, distended by the pus, will contract after its evacuation, and thereby the aperture will be rendered smaller than was intended.

55. The *cutting instrument* is used in the following manner: the blade of the *lancet* being held with the finger and thumb of the right hand, sufficiently far from the point to permit of its entrance into the cavity of the abscess, and the skin covering the abscess being stretched by the fingers of the left hand, the lancet is to be thrust perpendicularly or obliquely in till the pus, oozing up by its sides, shows that the cavity of the abscess has been opened; and the aperture is to be increased to a proper size by raising the point of the lancet as it is withdrawn.

If the abscess be deep and the coverings thick, it should be opened with a *bistoury*, which, being held like a pen, is to be thrust into the abscess in the direction of the muscular fibres, and the opening is to be enlarged on bringing it out. If the abscess be very deep, and in the neighbourhood of important parts, it is most advisable to divide the parts covering it by repeated cuts, and with the fore finger of the left hand to feel in the wound at which point the fluctuation is most perceptible. This precaution is specially to be recommended in deep abscesses of the coverings of the belly and chest.

After opening an abscess the pus must be allowed to flow out gradually of itself, or it may be assisted by gentle pressure; everything which can interfere with its escape must be avoided, the aperture of the abscesses should not by any means be stopped up, but only covered lightly with charpie and a warm moist poultice, or merely with the latter.

[Pressing and squeezing abscesses, for the purpose of emptying after they have been punctured cannot be too much deprecated. Unnecessary pain is inflicted on the patient by the rough handling, which bruises the distended and still inflamed walls of the abscess. One object in making the puncture is to relieve the tension of the adjacent parts, and the escape of a very small quantity of pus immediately effects this. But the abscess empties itself sufficiently quickly by the simple contractibility of the skin, which gently presses out the fluid contents with little or no pain to the patient.

It not unfrequently happens that if the walls of the abscess be thick, the clean cut edges of the puncture are found adherent, and the aperture closed within twenty-four hours. The adhesions, however, are easily broken through, and the opening re-established by a little gentle pressure on the abscess. But I think it preferable, after making the puncture, to introduce between the lips of the wound a very small portion of lint, with a long end hanging out: this is to be removed when the first poultice is replaced a few hours after making the puncture, which by that time is sufficiently established.—J. F. S.]

56. *Escharotics* are employed in the following manner: a piece of linen spread with sticking plaster, and in which a properly shaped hole has been cut, is to be so laid upon the abscess that the aperture should correspond with the point where it is intended to be emptied. The hole in the plaister is then to be filled with bruised and moistened caustic, and covered with sticking plaster. After six or eight hours the plaister is to be removed, if the caustic have produced a good slough, or the walls of the abscess have been eaten through and the pus escaped. The slough is to be pierced with a lancet and the abscess emptied, or, if the emptying does not seem urgent, the slough may be allowed to separate, and then the lancet is to be introduced. The pus is to be discharged by moderate pressure in an unbroken stream, the aperture to be covered with sticking plaster and a bandage applied. The walls of the abscess frequently at once unite, but most commonly a smaller quantity of pus collects, the emptying of which is to be performed by a second puncture, and the union furthered by a compressing bandage.

57. In passing a *seton* through an abscess an aperture with a lancet is to be made at its upper part, through which a blunt probe, armed with a bundle of several cotton threads some yards long is to be passed to the very bottom of the abscess, till its extremity is felt against the skin. An assistant retains the probe in this situation, and the skin being rendered tense, a cut is made upon the probe, which is then to be drawn out and the seton introduced into the cavity of the abscess. This may be done with a seton needle, in which case the parts covering the abscess are to be raised into a fold and then transfixed with the needle. When the abscess is emptied, the opening is to be covered with charpie and sticking plaster, the seton thread fastened, the whole covered with a compress and supported with a proper bandage. A fresh portion of the thread is to be drawn in daily. When the suppuration has diminished the threads are to be withdrawn and the union of the walls promoted by regulated pressure. In many cases the seton may be removed in three or four days, if the walls of the abscess have acquired a sufficient degree of inflammation to unite by proper pressure.

58. In general the opening of abscesses with a cutting instrument is most preferable. The application of escharotics is accompanied with great pain; a part of the skin is always destroyed, in consequence of which a large scar remains. The seton is also painful and excites more or less severe inflammation. These modes of opening are therefore restricted to those cases in which it is desirable to excite a certain degree of inflammation, as will be presently mentioned in speaking of cold abscess. The employment of caustic in critical abscesses, in order to hasten and bring about their opening at an earlier period, may be conveniently replaced by the proper use of poultices, and the ordinary method of opening with the lancet.

[Puncturing abscesses is in all cases to be preferred. Escharotics are never permissible, as they produce a certain slough, the prevention of which is one object in emptying an abscess. The introduction of a seton is almost as objectionable; for the inflammation of the sac of the abscess which it excites will often be uncontrollable and hasten hectic fever.—J. F. S.]

59. The so-called *Cold Abscess* (Lymph-Abscess) resulting from lingering inflammation, (*par.* 15,) in which the covering skin is but little or not at all changed, may sometimes be dispersed by resolving poultices, infrictions, and plasters, by producing artificial wounds in the neighbourhood, by the application of the moxa, and so on, with simultaneous attention to the constitutional disorder. This, however, seldom happens, and since, after they have been opened in the way of ordinary abscesses, or have opened of themselves in consequence of the diminished vital activity of their walls, and the generally depressed state of the system, a very ill-conditioned and frequently fatal thin and copious suppuration sets in, special modes of proceeding in the treatment of these abscesses are therefore directed, in order partly to prevent the entrance of the air in opening them, partly to excite by the emptying of the swelling, such degree of inflammation as will produce their union, or the secretion of a good plastic pus, and then the cure is effected as in common abscess.

60. The modes of treatment to this end are, the emptying of the swelling with a lancet puncture or with a trochar, without admitting air, after which the opening is to be closed with sticking plaster, a moderately compressing bandage applied, and the opening frequently remade, till the union of the walls of the abscess has taken place (ABERNETHY ;) opening with the lancet after the previous application of caustic (BEINL ;) the introduction of a seton or a bundle of silk threads, to be withdrawn on the third or fourth day, and the cure then perfected by compression (WALTHER ;) tapping with the trochar and injection of red wine, solution of bichloride of mercury, or of nitrate of silver (SCHAACK ;) or of boiling hot water (RUST ;) or a solution of fully neutralized nitrate of mercury (NASSE ;) the laying open of the swelling longitudinally throughout half its length, and filling it with charpie moistened with solutions of caustic (ZANG ;) and the removal of the skin from the whole extent of the swelling (CALLISEN.)

61. The variety of these modes of treatment proves, that neither of them separately taken is sufficient to meet our wishes. The choice of them must therefore be guided by the difference of constitution, by the more or less weak state of the cellular walls and by the size of the swelling. If the tumour be not be very large and the constitution of the patient still tolerably good, perfect closing of the cavity of the abscess may usually be produced by repeated puncture with the lancet or trochar, or at least it may be so much diminished that we may be able to effect a cure by laying it open with a bistoury, and filling it with charpie, moistened with irritating remedies, especially solution of nitrate of mercury. In swellings of larger size it is far preferable to make the opening with caustic, or by the introduction of a seton. If the cure be not in this way effected, and, if suppuration threatening exhaustion occur after artificial or spontaneous opening, it is proper to remove from the front wall of the swelling as much as may be allowable, or to fill the whole cavity with charpie, which, according to the various degrees of irritating, is to be moistened with a stronger or weaker solution of nitrate of silver, or nitrate of mercury, to bring about a good suppuration. I am, however, convinced, that by the employment of these violent modes of treatment, the very worst symptoms are often produced which are dreaded in the common mode of treating abscesses. At least, I have in very many cases of cold abscess made the opening at the proper spot in the usual

way with the lancet, and, without the use of any other local means than moist warm poultices, the cure has been effected more quickly and with less trouble than by other modes of treatment. The opinions relative to the treatment of this cold or lymphatic abscess are so various, doubtless because they are confounded with *congestive abscess* and with the swellings of mucous bags (*par.* 17.) Corresponding general means must be employed with the local treatment; we must use strengthening remedies bark, rhatany, sweet flag, with diluted acids, a strong nourishing diet, and attention must be paid to cleanliness and good air.

According to Kluge (*a*), the lymph should be discharged by an incision, or, if that be not sufficient, the whole front wall of the swelling must be cut away, the opening of the hardened lymphatic vessel must be found, which is usually superficial and easily discernible by the trickling of the lymph; a bristle must be introduced into its open mouth, and then the vessel must be slit up for half an inch or an inch, until the healthy trunk is reached. The bristle is then to be removed, and either a compressing bandage applied, or, if there do not occur a proper degree of inflammation, the opened lymph-vessel must be touched along the part which has been slit open with a pointed piece of nitrate of silver up to the healthy portion, and then the compress applied.

Upon the subject of opening abscesses consult

Abernethy on Chronic and Lumbar Abscesses, in his Surgical Works, London, 1815, vol. ii. p. 153.

Schaack und Mursinna, über de oft unzulängliche Hülfe bei lymphatischen Geschwülsten: in Mursinna's Journal, vol. i. p. 2. 1800.

Beinl, A., von einer eigenen Art Lymphgeschwülst, und der zweckmässigsten Methode, die selbe zu heilen. Wien, 1801. In Abhandl. der med. chir. Josephin Akademie in Wien, vol. ii.

Rust, einige Reflexionen über die Natur und Heilung der Lymphgeschwülste, in Harless Jahrbüchern der teutschen Medicin und Chirurgie, vol. i. p. 155. And in Rust's Magazin, vol. i.

Jacopi, Operazioni e Sperienze fatti nel instituto clinico di Chirurgia di Pavia nel anno 1812, 1813, vol. ii.

Chelius, in neuen Chiron herausgegeben von Textor, vol. i. part i.

von Walther, über die wahre Natur der Lymphgeschwülste; in Journal für Chirurgie und Augenheilkunde, vol. i. p. 584.

62. The further treatment after opening an abscess must be quite simple; *we must endeavour to keep up merely a free undisturbed escape of pus, and to preserve a proper vital correspondence.* No further local treatment is required beyond the use of moist warm poultices. The edges of the opening draw together, the walls of the abscess approach and adhere, granulations (*Fleischwarzen*, Germ.) are produced from the bottom of the abscess by the development of fine vessels and delicate cellular tissue, which become more and more solid, are covered with a thin skin, and form a scar (*Cicatrix*, Lat.; *Narbe*, Germ.; *Cicatrice*, Fr.) A more active degree of inflammation, when continued or developed after the opening of the abscess, in consequence of which its edges swell, its neighbourhood becomes very sensitive, and the suppuration diminished, is usually consequent on improper treatment, on the use of tents and so on, and can only be relieved by the aforesaid treatment, which diminishes the irritation.

63. If a proper degree of vitality be wanting in weak constitutions or in abscesses in parts far distant from the heart; if the edges of the

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(*a*) Zembsch, as above.

abscess be flabby, insensible, discoloured; if a thin lymphatic sanious fluid be secreted; these are indications for the employment of more or less stimulating remedies, the *ung. digestivum basilicum*, the oil of turpentine, decoction of oak bark, bark with tincture of myrrh, filling the cavity of the abscess with charpie, strong solution of nitrate of silver, with which is to be moistened the charpie laid in the cavity of the abscess. But all these means are superfluous; the moist warm poultices are more effectual in raising the vital activity necessary for the secretion of good pus, the pus thereby more readily escapes, and the patient is saved from the troublesome and painful dressings by the sticking of the bandages. If the patient's strength fail and general weakness ensue, strengthening remedies, bark, rhatany, sweet flag, good nourishment, the enjoyment of pure air, and so on, are indicated.

64. If the edges of the abscess-aperture unite, whilst the secretion of pus continues, they may be easily drawn asunder or separated with a probe. Should the opening become too small, so that the pus cannot escape freely, it must be enlarged with the knife. If the granulations are developed too strongly, the *proud flesh (Caro luxurians*, Lat.; *Wucherndes Fleisch*, Germ.*)* must be touched with nitrate of silver and a compressing bandage applied, by which cicatrization is specially encouraged.

65. When the pus does not escape properly, but collects in the abscess, (which may depend on the opening being too small or upon some peculiar situation of the abscess,) it sinks down in consequence of its own weight, or the little opposition which the loose cellular tissue in the interspaces of the part offers to it, or the suppurative process may extend with failure of the adhesive inflammation, and, on the other hand, an ulcerative absorption may favour the extension of the abscess, and form cavities or canals which are called *fistulous passages (sinus fistulosi.)* These fistulous passages are often consequent on improper treatment, if the opening of the abscess be stopped by plugs, and so on, and the due flowing of the pus thereby prevented. Under these circumstances a much larger quantity of pus escapes from the abscess than from its size might be expected; especially if its neighbourhood be pressed in different directions; examination with the probe gives certain knowledge of its extent. If such fistulous passages remain long, their walls are overspread with a soft fungous membrane, similar to mucous membrane, which prevents the healing, and, when still longer continued, assumes a whitish, hard, callous condition.

The membrane of the fistula first pointed out by HUNTER, has been well described by VILLERMÉ (*a*), LAENNEC, and BRESCHET (*b*).

[The passage in HUNTER here alluded to is the following:—"When the parts are unsound, and of course the granulations formed upon them unsound, we have not this disposition for union, but a smooth surface is formed, somewhat similar to many natural internal surfaces of the body, and such as have no tendency to granulate, which continues to secrete a matter expressive of the sore which it lubricates, and in some measure prevents the union of the granulations. I imagine, for instance, that the internal surface of a fistulous ulcer is in some degree similar to the inner surface of the urethra, when it is forming the discharge commonly called a gleet. Such sores have therefore no disposition in their granulations to unite, and nothing can produce an union between them but altering the disposition of these granulations by exciting a considerable inflammation, and probably ulceration, so as to form new granulations, and by these means give them a chance of falling into a sound state." (p. 480.)]

(*a*) In Journal de Médecine, par LE ROUX, July, 1815.

(*b*) Dictionnaire des Sciences Médicales, vol. viii. p. 206. Journal von GRAEFE und WALTHER, vol. ii. part iv.

66. These fistulous passages may be generally avoided by the treatment already mentioned. If the fistulous passage be still recent, the free escape of the pus may be effected by a suitable enlarging of the opening, by the entire division of the fistulous passage, if it be superficial; or, if the bottom of the passage be near the skin, by means of a counter opening; for the latter purpose a probe is introduced, with which the bottom of the passage and the skin above it are raised, and then the probe is to be cut upon. The further treatment is to be according to the preceding rules. In still longer continued fistulous passages, especially when their walls have become callous, we endeavour to excite a proper degree of inflammation of the walls of the passage, usually by the introduction of a seton, or of a bundle composed of many threads, which is tied together externally upon the fistulous passage, and daily drawn tighter (**Langenbeck**) (*a*), or by the injection of irritating fluids (H. **Dewar**) (*b*); for instance, a solution of nitrate of silver, of bichloride, or nitrate of quicksilver, or by the introduction of a bougie, the point of which has been smeared with powdered nitrate of silver (**Cramer**) (*c*), (von **Walther**) (*d*), and so on, and then, by a regulated pressure throughout its whole extent, to produce union of its walls. Where a satisfactory dilatation of the fistulous passage is possible, the cure may be effected without these painful remedies by the careful avoidance of any bandage which might interfere with the escape of the pus, and by close attention to the before-mentioned rules.

According to **Langenbeck**, the introduction of a ligature is, in many cases, preferable to incision, which oftentimes is impracticable without injuring large vessels, and so on. By the ligature inflammation is produced, the surface of the abscess becomes red and painful, the secretion of ichorous fluid is diminished, good consistent pus and near the ligature shooting healthy granulations are produced, and the skin becomes more firm and solid. As these symptoms come on, the ligature is to be gradually drawn tighter. In common cases, the ligature requires to be used only from four to eight days, to produce its effects. If it should be necessary to cut through the wall of the fistulous passage with the ligature, the remaining cavity must be filled with charpie.

67. During suppuration the practitioner must pay especial attention to the condition of the digestive organs; for impurities in the intestinal canal are frequently the cause of unhealthy pus; neither must pure healthy air be forgotten.

If the suppuration be continued on account of any dyscracy, the proper means for its counteraction must be employed.

On the treatment of abscess compare

von **Kern**, Annalen der chirurgischen Klinik zu Wien, vol. i. 1807, vol. ii. 1809.

von **Walther**, über die topische Behandlung und über den Verband der eiternden Wunden, der Abscesse, Geschwüre und Fisteln, in Journal für Chirurgie und Augenheilkunde, vol. ix. part ii.

68. The treatment of the Hardening into which inflammation has subsided has a double object, viz. its *dispersion* or its *removal with the knife.* The resolution of the hardening is only possible when the lymph poured into the cellular tissue has not yet consolidated the walls of the part with each other, and its natural structure is not yet entirely lost; consequently, when the *induration is still recent and not very hard.* If there be also decided dyscracy, the curative treatment must be first directed to it.

(*a*) Von der Behandlung der Fistelgänge, der Schusscanäle und grosser Eiter absondernden Höhlen; in Neue Bibliothek für die Chirurgie und Ophthalmologie, vol. i. p. 2, par. 313.

(*b*) On the Treatment of Sinuous Ulcers; in Medico-Chirurgical Transactions, vol. vii. p. 487.

(*c*) Beitrage zur Heilung der Fisteln und Geschwüre; in Heidelberger clinischen Annalen, vol. x. part i. p. 71.

(*d*) Über Hohlgeschwüre und Fisteln; in Journal von **Graefe** und **Walther**, vol. v. p. 1.

For the resolution of hardening it is usual to employ the *saponaria*, the *taraxacum*, *gramen*; the *gummi ammoniacum*, *galbanum*; *cicuta*, *belladonna*, cherry-laurel water, various preparations of mercury and antimony; the soaps, alkalies and so on: for external use, warm bathing especially with or without alkalies, infriction of volatile salves, mercurial ointment; various plasters, the *empl. de cicutâ c. ammoniaco*, *de mercurio c. camphorâ* and so on; fomentations of narcotic plants; electricity, and galvanism. The repeated application of leeches, the internal and external use of mercury, and iodine, the employment of derivative remedies, with a better regulated and rather strict mode of living, act most satisfactorily.

69. These means must be used with discretion, and not pursued too long, because, otherwise, the general health will be much disturbed or inflammation and transition of the hardening into other kinds of disorganization, or even into cancer, may be produced. When, therefore, resolution is not effected, or when it cannot be attempted, it is most advisable to remove the hardened parts with the knife. If the patient will not submit to the operation, the hardening must be protected as much as possible from external influences; it must be kept warm, attention must be paid to the secretions and excretions; the patient must live regularly, and specially preserve himself from all depressing emotions of the mind.

70. Gangrene is always the loss of vital activity in some part; but the variety of its causes and of the circumstances connected with it render very different kinds of treatment necessary, *in order to stop the further spreading of the gangrene, to assist nature in throwing off the gangrenous part, and to prevent the operation of the gangrenous juices acting upon other parts of the body.*

71. Gangrene may be specially connected with inflammatory, nervous, or gastric fever, with general debility or increased sensibility and convulsions.

When it is consequent on active inflammation and accompanied with inflammatory fever, which is specially the case in young strong persons after external injury and so on, a moderating antiphlogistic treatment can only be employed, and emollient poultices to hasten the throwing off the gangrene. If the gangrene arise from the confinement of the inflamed parts by unyielding aponeuroses, the removal of these mechanical hinderances, by suitably deep and extensive incisions, can alone prevent the production or further spreading of the gangrene.

In most cases the gangrene is connected with general debility, nervous or putrid fever, and then especially is indicated the use of bark with valerian, arnica; serpentaria, fluid hartshorn, diluted acids; naphtha, wine, and so on; if there be putrid symptoms, bark with mineral acids and alum. It must not be forgotten, however, that not unfrequently, under these circumstances, wine and animal food decidedly increase the febrile heat, the pulse becomes quicker, the tongue coated, and the patient very uneasy. A less irritating diet, and only so much mild, nourishing, and farinaceous food as the appetite requires and the stomach can bear, is then more proper.

Not unfrequently in gangrene there is a loaded state of the bowels, which must be as early as possible removed, and then the strengthening remedies employed. In greatly increased sensibility and convulsions, opium, musk, fluid alkalies, and other antispasmodic means are to be used.

72. The *Local Treatment* of gangrene has the two-fold purpose of supporting nature in throwing off the slough and in diminishing the dangerous operation of the gangrenous juices.

If the gangrene be connected with active inflammation, softening, and in very severe pain, soothing poultices are to be used; but, if the gangrenous part be free from pain and shrivelled, stimulating remedies are required, in order to excite suppuration on the boundary of the slough; with which object it is most advisable to use warm aromatic poultices.

The remedies which prevent the influence of the gangrenous juices, by absorbing or decomposing them, are quinine, oak or chestnut bark, camomile, vinegar, wine, brandy, camphor, hydrochlorate of ammonia, turpentine, diluted mineral acids, pyroligneous acid, carbonic acid, effervescing fluids, powdered charcoal. In moist gangrene, these substances are better used in powder, but in dry gangrene fomentations or poultices. In all cases the stench is best diminished by the employment of aromatic or simply moist warm poultices, and by suitable cleansing at each time of their renewal. It is still further lessened by the very useful strewing of powder, which, by its partial drying, often directly prevents the outflowing of the gangrenous juices.

The operation of these remedies may be promoted by scarification or cutting into the gangrenous parts. The scarifications must not, however, penetrate into the living part, or they will favour the action of the gangrenous juice, accelerate the increase of the gangrene and cause dangerous bleeding; their principal object must be *to prevent the collection of the gangrenous juices.* In the gangrene of old people (*gangræna senilis*) scarifications are always dangerous; so long as the toes are still attached at some parts, they must not be removed.

73. The sloughs having been thrown off by this treatment, the remaining wound must be managed according to the rules laid down for treating abscesses, and the vital activity of the patient must be supported by the suitable employment of bark and a nourishing strengthening diet.

74. In most cases nature, after the gangrene is defined, throws off the gangrenous part, and *amputation is not required.* Amputation *is not applicable* in gangrene depending on an internal cause which is still in operation; for, in such case, after the performance of amputation, gangrene again takes place in the wound. But when the gangrene has affected the whole thickness of a limb, and is defined, and the separation of the dead part cannot be expected; or, when produced by external violence, it is proceeding, but the causes of the gangrene can be removed with the gangrenous part, amputation is to be considered as necessary and likely to save life (1). It is, however, here to be borne in mind that gangrene in the deeper parts commonly makes further progress than the external appearance indicates. The amputation must always be performed in the healthy part.

(1) Such is the opinion of Larrey (*a*); but the opposite is especially supported by Pott.

When the gangrene remains stationary, the greatest danger is over. However desirable it may be to relieve the patient of the mortified part, yet in many cases is he unable to bear the shock of the operation. Here, then, in combination with a treatment suited to the diseased condition of the patient, it is more advisable, if the soft parts are divided down to the bone, to saw the latter through below the limits of the healthy part. Diseased condition of the remaining ulcerated surface, may at a subsequent period render amputation necessary.

[So far as my experience is concerned, I believe that amputation should on no account ever be performed, so long as the gangrene is in progress, whatever be its cause;

(*a*) Mémoires de Chirurgie Militaire, vol. iii. p. 142.

for, if it be, the same action will be set up in the stump, and the patient's condition rendered worse by the shock of the operation. Only when the gangrene is proved to have stopped, by the line of separation having descended to some depth in the soft parts, is amputation to be entertained.—J. F. S.]

75. The treatment of *senile gangrene* must depend on the different modes in which it has arisen (*par.* 26.) When livid redness and swelling set in as a consequence of injury, or any other locally operating mischief, softening, soothing, or dry aromatic compositions must be applied, according to the circumstances; in more active inflammation, and in robust persons, leeches should be used. It is proper to allude to these cases, and especially when occurring in plethoric subjects, as DUPUYTREN (*a*), by the employment of the antiphlogistic method, by bleeding and leeching, professes to have met with successful results. The general treatment must correspond with the local; in very severe pain opium in considerable doses should be given (*b*), and, according to circumstances, with tonic medicines. In the other kind of senile gangrene, which comes on with blackening and shrivelling of the part, tonic means in combination with volatile applications with the addition of opium if there be pain, and the local employment of soothing poultices, can alone produce the limiting and throwing off the slough, and respite life for some time.

I have communicated (*c*) an interesting example of senile gangrene of the hand and fore arm, in a woman of eighty-two years of age, in which by proper support of the powers separation of the slough and healing ensued. Compare also HEIM (*d*).

76. Gangrene from pressure by lying is to be guarded against by suitable preparation of the bed, by lying on a mattress instead of a feather-bed, by proper cleanliness, frequent change of the body-linen and sheets, repeated alteration of position, by putting doe-skin beneath the patient, by frequent washing the compressed parts with cold water, lead wash and camphorated spirit. If the part have become red, it must be laid on a hollow formed by introduction of ring-shaped pads, little bolsters of horsehair, cleft mattresses, and afterwards compresses moistened with lead wash, vinegar, or THEDEN's arquebusade water must be applied, or the part must frequently be smeared with an ointment of white of egg and camphor beaten to a cream. When ulcerative absorption has occurred, softening poultices, ointment of oxide of zinc, or of lead, with opium or camphor, should be applied, and, if the ulceration be spreading and deep, aromatic poultices. If actual gangrene be present, then the ordinary treatment for gangrene must be employed. Of course the treatment of the patient's health should be guided by the state of the disease.

In many cases where it is difficult to move the patient, the application of local means may be assisted by the use of LECAT's suspending mat (*e*), or LEYDIG's (*f*) apparatus for raising invalids.

77. In gangrene after the use of cockspurred rye, vomiting and purging must be had recourse to, and subsequently both internal and external stimulating remedies. In many cases amputation has been performed, which, however, has not always been of service, because, especially in patients who had been much weakened, the same changes took place in the stump. If the gangrene has become defined, it is most

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(*a*) In BALLING, as above.

(*b*) POTT, Observations on Frostbite on the Toes and Feet; in his Surgical Works, vol. iii. p. 189 *et seq.* Ed. 1808.

(*c*) Heidelberger klin. Annalen, vol. vi , part i.

(*d*) Schweiz. Zeitschr. für Naturw. u. Heilk, vol. ii. part. i. p. 73.

(*e*) Philosoph. Trans. 1742, p. 346.

(*f*) Der Krankenheber, &c., mit 2 Kupf. Mainz, 1812.

advisable to leave the separation of the parts to nature and saw off the bone.

Full reports of observations on this subject are to be found in THOMSON (*a*) and in SAMUEL COOPER (*b*).

78. The treatment of *malignant pustule* varies according to the accompanying symptoms. The local treatment consists in cutting out the pustule by a circular incision, and afterwards cauterizing the edges of the wound with nitrate of silver or sulphuric acid, (also with the actual cautery,) and placing upon it charpie moistened with oxymuriatic acid. The slough is to be covered with a softening bran poultice, and, after it is thrown off, the treatment of the wound is to be simple. If the pustule be not deep, but the slough much outspread, it is proper to make deep scarifications and employ the remedies just mentioned. If general symptoms are not present, it is only necessary to use sulphuric acid or HALLER's acid mixed as a drink. If there be indications of gastric impurities, emetics must be employed in divided but sufficiently effectual doses, and, if they do not operate, purging, or vinegar clysters must be used. If the powers sink and nervous symptoms appear, strengthening and stimulating medicines are required; bark, serpentaria, arnica, valerian with elixir of vitriol, hydrochloric acid, and so on. But bleeding is rarely required, unless in decided plethora and great determination of blood to the head and chest.

On malignant pustule see

LARREY, as above, vol. i. p. 52.

HUFELAND's Journal, vol. li. part v.; vol. liv. part iii.; vol. lvi. part iv.

RUST's Magazine, vol. xv. part i.; vol. xvi. part iii.; vol. xvii.

J. N. HOFFMANN, der Milzbrand, oder contagiöse Carbunkel der Menschen, mit Beruchsichtigung einiger damit zu verweckselnder Krankheitsformen und einer fragmentarischen Uebersicht des bei den Thieren herrschenden Milzbrandes. Stuttgardt, 1827. 8vo.

RASEDOW, die schwarze Pocke; in Journal von VON GRAEFE, u. VON WALTHER, vol. vii. p. 185; vol. xii. p. 549.

SCHROEDER, über die schwarze Blatter; in RUST's Magazin, vol. xxix. part ii.

WENDROTH, über die Ursachen, Erkentniss und Behandlung des contagiösen Carbunkels. Sangershausen, 1838.

79. It is apparent, from the nature of the causes of *hospital gangrene*, already mentioned in what way this dangerous complication of wounds and ulcers can be guarded against. Care must be taken as much as possible for purity of air and proper diet with a moderate use of wine; the greatest cleanliness of the bandages must be observed, the wound must be washed with a light aromatic infusion or with diluted alkaline solutions, and symptoms of gastric impurity must be removed by vomiting and purging. Emetics are especially advised by POUTEAU, DUSSAUSOY, and others, as the most important remedies at the beginning of the disease. They recommend them as being of themselves capable of stopping the advance of the disease.

If the peculiar changes occur in the wound or in the sore, (*par.* 35,) washing the whole surface with good vinegar, after thoroughly cleansing with charpie, and frequently moistening the bandage with vinegar, is often sufficient at the onset to restore the wounds in a few days to their former condition. For the same purpose also is the solution of arsenic recom-

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(*a*) As above, p. 538.

(*b*) Dictionary of Surgery, article Mortification.

mended. If the surface of the wound do not improve in appearance, its entire extent should be touched with nitrate of silver, or conical pieces of caustic laid in the viscid mass. But, under these circumstances, the most important remedy is the free application of the actual cautery to the whole surface of the ulcerated part. The slough is to be covered with powdered bark and turpentine or some stimulating salve, and when the slough has separated, the appearance of the wound must determine whether the application of the cautery is to be repeated or not. Besides these means, the following may also be recommended ; decoction of bark, diluted mineral acids, especially hydrochloric acid, yeast poultices, spirituous lotions, brandy and myrrh, aloes and camphor, hydrochlorate of ammonia with water and vinegar, *spir. terebinth*, *ung. styrac.* and *Egyptiacum*, balsam of copaiva, solutions of bichloride of mercury and nitrate of silver, butyr of antimony, pyroligneous acid, lemon juice and so on.

80. General treatment, suited to the different condition of the patient, must also be connected with this local treatment. At the onset, if symptoms of irritation and active febrile excitement are present, acid drinks, especially dilute mineral acids, are serviceable ; in impurities of the stomach, emetics ; in great weakness, bark and other tonic remedies ; only in rare cases is a strict antiphilogistic plan of treatment called for. The diet must of course correspond with the general treatment, and care should be taken for purity of air and keeping the patient apart from others.

On hospital gangrene compare

POUTEAU, Œuvres Posthumes, vol. iii. 1783. 8vo.

GILLESPIE, LEON, Observations on the Putrid Ulcer; in London Medical Journal vol. vi. p. 373. 1785.

DUSSAUSSOY, Sur la Gangrène des Hôpitaux. Genève, 1787. 8vo.

BLANE, G., M.D., gives an account of this gangrene, by the name of Malignant Ulcer, in his Diseases of Seamen, p. 502, 3rd Edit., London, 1799.

TROTTER, M.D., describes it by the same title in his Medicina Nautica, vol. ii. p. 170 ; vol. iii. p. 467.

BELL, JOHN, Principles of Surgery, vol. i. p. 136.

LESLIE, De Gangrænâ Contagiosâ. Edinburgh, 1805.

JOHNSON, CHARLES, M.D., de Gangrænâ Contagiosâ Nosocomiale. Edinburgh, 1805.

THOMSON, JOHN, in his Lectures on Inflammation, p. 456.

RENARD, über den Hospitalbrand. Mairz, 1815. 8vo.

GERSON, über den Hospitalbrand, nach eigenen Erfahrungen. Hamburg, 1817. 8vo.

H. BLACKADDER, Observations on Phagedæna Gangrænosa. Edinburgh, 1818. 8vo.

W. WERNECK, kurzegefasste Beiträge zur Kenntniss der Natur, der Entstehung, der Verhutung und Heilung des Hospitalbrandes. Salzburg, 1820. Large 8vo.

BRAUER, Observationes quædam de Gangrænâ Nosocomiali, quæ anno hujus sæculi XIV. Lipsiæ inter milites variarum nationum grassata est. Lipsiæ, 1820.

ALEXANDER, über den Hospitalbrand; in Hippocrates Magazin von SANDER und WAEPTER, vol. v. p. 1—220.

DELPECH, Clinique Chirurgicale de Montpellier, vol. i. p. 78.

BOGGIE, in the Transactions of the Medico-Chirurgical Society of Edinburgh, vol. iii. p. 1. 1828.

OLLIVIER, A. F., Traité experimental du Typhus Traumatique, Gangrène ou Pourriture des hôpitaux. Paris, 1822. 8vo.

SECOND SECTION.—OF CERTAIN PECULIAR KINDS OF INFLAMMATION.

I.—OF ERYSIPELAS.

RICHTER G. G., Diss. de Erysipelate. Goetting, 1744. 4to.

THIERENS, A. L., Diss. de Erysipelate. Lugd. Batav., 1790.

WINKEL, L. H. O., Aphorismi de cognoscendo et curando Erysipelate. Erlang., 1794. 8vo.

FERNE, W. C. S., Diss. de diversâ Erysipelatis naturâ. Franc ad Viadr., 1795. 4to.

DESAULT, Observations sur Diverses Espèces d'Erysipèles; in Journal de Chirurgie, vol. ii. p. 13. 1791.

RUST, das Pseudo-Erysipelas, eine noch nicht hinreichend erkannte Krankheitsform; in his Magazin, vol. viii. part iii. p. 498.

HUTCHINSON, A. C., Practical Observations on Surgery. 2nd Edit. London, 1826. chap. ii.

PAULI, über Phlegmone telæ cellulosæ; in RUST'S Magazin, vol. xxvii. p. 129.

LAWRENCE, WILLIAM, Observations on the Nature and Treatment of Erysipelas; in Medico-Chirurg. Trans. vol. xiv. part i. p. 1.

DUPUYTREN, Du Phlegmon Diffus; in Leçons Orales, vol. ii. p. 289.

FENGER, C. E., Diss. de Erysipelate ambulanti. Haoniæ, 1842.

81. Under the terms *Erysipelas*, *St. Anthony's Fire*, (*Rosa*, *Erysipelas*, Lat.; *Rose* oder *Rothlauf*, Germ.; *Erysipèle*, Fr.,) is usually understood an inflammation of the lymphatic vascular network overspreading the surface of the cutis, in which, not unfrequently, the skin, glands, and Malpighian mucous net, but more rarely the cellular tissue and muscles lying beneath, partiticipate. Under this general notion are included a number of diseased conditions which are considered as modifications of erysipelas, but in their nature are entirely different from it. RUST has the merit of having pointed out their special points of difference, and recognises a *True Erysipelas* (*Erysipelas verum* seu *exanthematicum*, Lat.; *ächte Rose*, Germ.) and a *False Erysipelas* (*Erysipelas spurium* seu *Pseudo-Erysipelas*, Lat.; *unächte Rose*, Germ.)

[HUNTER long since observed, that "most inflammations that are not of the true adhesive and suppurative kinds are called erysipelatous, although, probably, they do not in the least belong to it." (p. 269.) And CHELIUS has echoed him in the above observation, that "a number of diseased conditions, which are considered as modifications of erysipelas, in their nature are entirely different from it." But he has not at all, by his arrangement, mended the matter, and I have, therefore, pointed out, first, the different applications of the terms erysipelas and erythema, which are employed by him very contrarily to our ordinary usage of them; and, afterwards, I have shown that one of his forms of erythema is really that important disease, inflammation of the cellular tissue, which, by other writers as well as by him, is confounded with inflammation of the skin, and often mentioned as gangrenous erysipelas. It is, however, right to observe that our author has, at the end of paragraph 83, shown that he is not unaware of the impropriety of considering this disease as an affection of the skin.—J. F. S.]

82. The *True Erysipelas* appears without any local disposition to disease, but with previous general indisposition, which is usually shown by

weakness and heaviness of the limbs, listlessness, pain in the region of the stomach, loaded tongue, nasty taste in the mouth, disposition to vomit, more or less active fever, head-ache, wandering, lethargy, or madness,—as a pale uncircumscribed redness of the skin, fading into yellowish, which spreads unequally, is shaded off towards the edge, disappears on pressure with the finger, but returns when the pressure is removed. After the appearance of the erysipelas the fever generally diminishes or disappears; but every fresh attack is accompanied with fever. The seat of this erysipelas never extends beyond the lymphatic-vascular net overspreading the surface of the cutis. The severity of the disease is as various as is the condition of the part first attacked; it, however, usually subsides under critical discharges of perspiration and urine, and with scaling of the skin; it never runs into suppuration, but only, with weakly constitutions and other concurrent circumstances, into ulceration and gangrene, in consesequence of which the destruction of the surface of the body extends to the parts beneath, and there ensues, not a bounded fluctuating abscess, but an open, wide-spreading, putrid, ulcerating surface. If the scaling of the skin, critically following the erysipelas, be disturbed by moist remedies, by cold and so on, dropsical swelling ensues. This erysipelas is very fugitive; it subsides of itself; but more commonly after the external use of moist remedies, of cold, or on mental emotions, and so on, it suddenly quits the surface, and causes inflammation of the brain, chest, or belly, madness, convulsions, paralysis, and so on. The true causes of this erysipelas are biliary irritation, disturbance of the functions of the liver, collections of gastric impurities, use of indigestible food, obstruction in the portal system, and a prevalence of peculiar atmosphere and temperature, in consequence of which it seems to be commonly epidemic, especially towards autumn and during summer.

Compare BALLING, das Akklimatisations-Erysipelas; in Heidelberg Klinischen Annalen, vol. vii. p. 176

The *Vesicular Erysipelas (Erysipelas vesiculare, bullosum)* is a variety of this kind of erysipelas, in which either at the onset, or in the course of the disease, vesicles of various size arise, sometimes like a miliary eruption, sometimes like peas or hens' eggs, which often run together, and, after bursting, form crusts, or, frequently, spreading sores.

[(1) The disease here described as true erysipelas by CHELIUS, is the *erythema* of English practitioners, and which has been well described by WILLAN (*a*) as "a nearly continuous redness of some portion of the skin, attended with disorder of the constitution, but not contagious" (p. 472;) and BATEMAN (*b*) observes, that "it differs from erysipelas inasmuch as it is a mere rash or efflorescence, and is not accompanied by any swelling, vesication, or regular fever." (p. 119.) RAYER (*c*) speaks of it as a superficial inflammation of the skin, characterized by morbid redness and heat. and the absence, for the most part, of papulæ, vesicles and pustules. (vol. i. p. 98.) Elsewhere he observes, that "it is the first stage of a number of cutaneous affections, but when permanent it constitutes a disease in itself." (p. 95.)

The vesicular erysipelas, which CHELIUS considers merely as a variety of his erysipelas, is a distinct and definite disease, the acute erysipelas of WILLAN and BATEMAN, which "most frequently occurs in the face, affecting usually one side of it only; sometimes it seizes one of the extremities, and in both cases it is ushered in by a smart feverish attack. The colour is higher than in the other species of the disease, and the burning heat and tingling in the part are exceedingly distressing. The swelling generally appears on the second night or third day of the fever; the vesications rise on the fourth and fifth, and break or subside on the fifth or sixth, when the redness changes to a yellowish hue, and the swelling and fever begin to diminish; and on the eighth day

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(*a*) On Cutaneous Diseases. Lond., 1808. 4to. according to the arrangement of Dr. WILLAN.
(*b*) A Practical Synopsis of Cutaneous Diseases London, 1819. 8vo. 15th Edition.
(*c*) Traité Théorique et Pratique des Maladies de la Peau. Paris, 1826. 2 vols. 8vo.

both disappear; on the tenth the new cuticle is commonly left exposed, the old one having separated, and the brownish or dark scab, which had formed where the fluid of the vesications had been discharged, having fallen off." The disease runs its course more quickly in the young than in those of more advanced age; and "the vesications, in the latter instances, are often succeeded by a profuse discharge of acrimonious lymph for several days, so that scabs do not form. Suppuration very rarely occurs in this species of erysipelas, especially when it affects the face." (pp. 126, 7.)

From this description it is quite evident that CHELIUS is incorrect in making his vesicular erysipelas a variety of his true erysipelas; the latter being really erythema, and therefore an exanthematous disease, whilst the former, which is our acute erysipelas, is a bullous disease. It was necessary also to make these observations to prevent the confusion which would otherwise arise from the acceptation in which CHELIUS uses the terms erysipelas and erythema, differing so entirely from that in which they are employed by English writers.—J. F. S.]

83. The *Spurious Erysipelas* or *Pseudo-Erysipelas* is a continual inflammation of the skin with some redness, (*Erythema*,) which has nothing in common with the true erysipelas but its external appearance, and is produced by any pretty strong irritation of the skin. Influences of this kind are, scorching by the sun, slight burning, cold, irritating ointments and plasters, cantharides, mustard plaster, horse-radish, the juice of toxicodendron, hard rubbing, wounds and injuries of all kinds, stagnant humours, swellings, hardenings, and so on. Hence inflammation of the skin is produced, either directly or indirectly; in the first case appearing immediately, in the second as a consequence of some other disease, which has been excited by inflammation. The inflammation of the skin, thus produced, is either superficial, or it penetrates deeper into the substance of the skin. The former is more like erysipelas, but the latter has rather the character of phlegmonous inflammation, and the more the cellular membrane and muscles are attacked by it, so much the less does the disease deserve the name of inflammation of the skin.

84. According to its various causes, *Pseudo-Erysipelas* is divided into two kinds:—

First. The *Erythema idiopathicum*, which is merely consequence of external irritation (from cold, heat, corrosive substances, slight injuries, and so on.)

[A very frequent form of idiopathic erythema is that caused by friction, and commonly known as *Intertrigo*, which is well exemplified in the chafing of the skin in fat persons; often also noticed in the folds of the skin of the neck, groin and hams, and behind the ears of infants, and resulting from inattention to cleanliness, the moisture and sebaceous secretions which are left on the delicate skin of these parts irritating it, so that often the character of the perspiration is changed to clamminess, and its quantity increased, and, where it can dry, superficial thin scabs are formed, even before excoriation of the skin occurs, which soon takes place, and, if left alone, runs on to gangrene. Erythema may also originate from the flow of other natural secretions over the skin, as the spittle over the chin and neck, if the lower lip be imperfect, or do not retain its proper place; the urine, in incontinence or in perineal fistula; the tears over the cheek; and so also the increased and altered mucous discharge from the nostrils during catarrh, will cause severe erythema of the upper lip.—J. F. S.]

Second. The *Erythema symptomaticum, consensuale*, which is the simple reflection of another disease of the structures lying deeper beneath the skin. This other disease may be,

A. An inflammatory or serous distension of the tendinous expansions, and aponeuroses, with the intensity of which the accompanying inflammation of the skin increases, and oftentimes spreads very far, as, for instance, in œdema, in injuries of the head, in whitlow, and so on.

[This is the "erysipelatous inflammation" which, HUNTER says, "often arises from accident; but then it is commonly a secondary inflammation, although not always; for, the first shall have gone off, and, when the suppuration was to take place, it shall have come kindly on, but afterwards the erysipelatous shall take place. * * * It is more commonly a cutaneous inflammation than situated in the deeper-seated parts; although, in some constitutions, every inflammation, wherever it exists, will most probably be of this kind; however, the skin appears to be most susceptible of it, because it will spread over a prodigious surface of skin, while it does not affect even the cellular membrane underneath. * * * It is more common in the summer than in the winter, more especially in hospitals; and, I think, takes place oftener after wounds on the head than any other. I have often seen it begin round a wound on the scalp, extending itself over the whole head and face; the eyelids being very much swelled, the ears thickened, and it has advanced to the neck, shoulders and body; creeping along both arms, and terminating at the fingers' ends: that which attacks the body, often goes along the body to both thighs, down the legs, and terminates at the ends of the toes; and, while this is going on, it is as expeditiously cured behind, and the skin peels off the cured parts: however, this is not always the case; it often stops, and where it proceeds so far, it is commonly becoming milder." (pp. 270, 1.)

The form of the disease just described by HUNTER, is the *erratic erysipelas* of WILLAN and BATEMAN. It, however, more commonly occurs on the limbs and body, than on the head, and frequently accompanies punctured wounds, or poisoned wounds in dissection. In the latter cases, it is often extremely troublesome, and continues for weeks; making its appearance in the neighbourhood of the wound, after the more severe symptoms, either without or with suppuration and sloughing, have subsided, and the patient seems nearly convalescent: it will run up and down finger after finger, consecutively, and I have known the fingers thus affected twice or thrice during the same attack.

That form of the disease which sometimes follows scalp-wounds is rather the *œdematous erysipelas* of WILLAN and BATEMAN than the erratic. It is described by those writers "of a paler red, or of a yellowish-brown colour, is accompanied by less heat and local distress" than true, or even erratic erysipelas; "its surface is smooth and shining, and, if it be strongly pressed with the finger, a slight pit remains for a short time." The scalp swells enormously, and the disease spreads more or less slowly and extensively, till "the whole face is much enlarged, so that the form of the features is scarcely recognised, and the appearance is not unaptly compared by WILLAN to that of a bladder distended with water." (p. 127.) Generally, as far as I have observed, this œdematous erysipelas is not accompanied with vesication.—J. F. S.]

B. A metastatic deposit in the cellular tissue, periosteum, and glands, in gastric, rheumatic, arthritic, and puerperal diseases. In such cases, when the masses deposited are fluid, the parts attacked quickly die, and are given up to the ulcerative process. Often, within a few hours, in a previously healthy part, (mostly of the thigh or leg, especially on the right side in persons advanced in years,) a redness of the skin comes on with fluctuation and diffused pain, in which, after opening the abscess, whole sheets of dead cellular tissue may be withdrawn; and, if the periosteum be involved, the bone may be felt bare. Usually, however, its course is not so quick; the local pain is preceded by more or less severe shiverings which, from their repeated accessions, resemble an ague. The fever continuing, the skin is rosy red at the painful parts, and somewhat œdematous, so that it retains the impression of the finger. The fever becomes more active, the swelling harder, the rèdness bluish, the skin grows shining and blisters, the cellular tissue is hard and firm, the urinary and fecal discharges are changed and suppressed; with accompanying restlessness, and great agitation. At this point the disease seems to stand still; the heat, tension, and pain are unaltered; the vesicles have the same appearance. If at this time the skin and cellular tissue be cut into, a quantity of whitish fluid with a little pus escapes, a few days after, less of the thin fluid, and more pus; and, still later, a whitish lard-like substance, and upon pressure only a very little pus; the cellular tissue is dead. When it has gone thus far, the skin is destroyed, the vesicles burst, a whitish ichorous fluid is discharged, whitish or blackish spots appear which quickly spread, the cellular tissue is thrown off in large patches, the skin is entirely separated from the underlying parts, all the connecting cellular tissue between the muscles is destroyed, the skin becomes gangrenous, the suppuration is very plentiful and offensive, the destruction spreads and exhaustion follows with copious sweats, purging, and so on. If the patient's powers revive, and the disease be arrested, the formation of granulations and cicatrization is always very tedious, on account of the great destruction of the cellular tissue (1). If the masses deposited be solid, they sink into the substance of the cellular tissue, inflame and harden it, and destroy its vital relations, without causing actual death. This degeneration frequently does not occur until after several weeks, and appears with accompanying redness of the skin and with a somewhat painful, far-spread, deep-seated hardening (2). The termination of this disease (which KLUGE has commonly observed in the scrotum, and which I have seen upon the hand and fore arm) is either a tedious resolution with gradual subsidence of the redness and hardness, or death of the degenerated organ, in which the size of the part is increased, the previous hardness becomes doughy, fluctuation takes place, and the above-described destruction and *ichorousness* ensues (*a*).

[(1) This is the *inflammation of the cellular tissue*, to which I slightly adverted at p. 72; and, although very commonly confused with erysipelas, or, as by CHELIUS, with erythema, it is decidedly different from either, although both occasionally run into it. JOHN HUNTER was well acquainted with it, as will be presently seen, though he included it with erythema, under the common title erysipelatous inflammation, which he does not describe at all. He says:—"The erysipelatous inflammation is very peculiar; and most inflammations that are not of the true adhesive and suppurative kind are called so, although probably they do not in the least belong to it; and this may arise more from the want of terms, than the want of discrimination." (p. 269.) After describing erythema, which it is quite certain he means, restricting it to the skin, he proceeds:—"When it (the inflammation) goes deeper than the skin into the cellular membrane, it often suppurates; but then I suspect it is not the true erysipelatous; for, in such cases, it commonly produces mortification in the cells, by which air is let loose; this gives a strange feel, neither of fluctuation nor crepitation, and, as there are no adhesions, the matter finds an easy passage into the common cellular membrane, increasing the same kind of suppuration wherever it comes; and, as mortification is a consequence of these inflammations, putrefaction ensues, and the discharge becomes very offensive. * * * * When it produces suppuration in the cellular membrane it is often dangerous, both from the disease itself and the consequences of the matter diffusing itself much farther. * * * The sores seldom ulcerate; they should be opened early, or the matter either gets into the cellular membrane from the want of adhesions, or it separates parts that are only attached, as the periosteum from the bone, muscles from muscles, etc. Whereas the true suppurative ulcerates briskly, which therefore should not be opened early, but allowed to burst." (pp. 271, 2.)

So far as it goes, HUNTER has well described this disease; but he speaks of it as if invariably consequent on erythema, which is more rare than its following erysipelas, which he does not mention at all. It is perfectly true that, from both these diseases, the inflammatory action may descend, and attack the cellular tissue; but very commonly the inflammation begins in that tissue; and the redness of the skin is only secondary, and symptomatic of the mischief going on beneath.

Inflammation of the cellular tissue arises frequently without any apparent cause, but sometimes follows a graze or slight wound or contusion of the skin. It commences with swelling, tension and dusky redness of the limb, (almost invariably attacking the extremities,) is very painful, and has a doughy feel; it spreads very rapidly, downwards as well as upwards if it have commenced on the upper or on the middle of the lower member of the limb. The pain and tension increase, the redness becomes darker, and, if not interfered with, large patches of the skin assume a gangrenous character, sometimes accompanied with large vesications loaded with dirty serum, but very often without

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(*a*) KLUGE; in RUST, as above, p. 525.

them. Pressure upon the skin not unfrequently gives a crackling sensation. The gangrene of the skin continues spreading, and, generally, in the course of forty-eight hours or less, the greater part, or the whole, of the skin is sloughy. If there be sufficient power, ulceration takes place at the edge of one or other slough, and a little ichorous exudation is observed, which subsequently is followed by fetid pus, and sloughs begin to separate, simultaneously with which the character and quantity of suppuration are improved and increased, till the whole of the dead parts are thrown off; but this is a result which can scarcely be expected, for the patient is generally worn out before this can take place. The constitutional symptoms in this disease are at first those of great excitement and general disturbance; the skin burning hot and dry; the pulse quick and full; the alvine secretion unhealthy and the tongue dry; the patient becomes restless, soon wanders, becomes delirious, often violently, and then drops into a typhoid state, in which condition he speedily sinks. The disease is easily distinguishable from erysipelas, by the absence of vesication at the onset, and by its darker redness; also by its usually occurring in the limbs. But, as I have already mentioned, erysipelas may subside into it, as it not unfrequently does when attacking the scalp, and occasionally also when the face is affected, specially when the regions of the orbits are concerned, in which cases I have seen some very fearful sloughing of the cellular tissue in those cavities.

The disease generally attacks adults, and more especially persons accustomed to large quantities of beer and spirits, and gross feeding. In such persons the disease often seems to occur spontaneously, and at other times from the slightest cause, as a mere scratch. But I do not agree with CHELIUS that metastasis is generally, if ever, the cause of the disease.—J. F. S.]

(2) I have once or twice seen this degeneration in the scrotum; and I think I have noticed it occasionally in the legs of people addicted to drinking, in whom it seems to have been a commixture of adhesive deposit with the serum of œdema. But, many years ago, I had under my care a woman, between twenty and thirty years of age, whose face was thus affected, consequent on repeated attacks of erysipelas previous to my seeing her. Her forehead, and face especially, were considerably swollen and fiery red, having the appearance of skin distended with œdema, and threatening to burst; but it had not any such disposition. When pressed, it was found firm and but little yielding. She did not suffer pain in any material degree, but was principally inconvenienced by both eyelids being included in the disease, and so swollen that their apertures were little more than narrow horizontal slits, so that without bowing her head much forwards she could see nothing immediately below her for a considerable distance. All sorts of constitutional and local remedies having been employed without avail, it was proposed to her that some slices (they could only so be properly called) should be taken out of the swollen eyelids. To this she readily assented, being anxious for the slighest chance of relief; and, performing an operation similar to that for entropium, I removed a .horizontal slice from between each tarsus and the corresponding edge of the orbit of both eyes, digging down to the bone, to the depth of half an inch, and cutting through cellular tissue literally converted into brawn; the gaping edges were then brought together, and, at first, she seemed a little benefited; but the wounds soon healed, and no advantage was derived. In a second operation, I removed some short vertical slices from the lower lids, but not with much immediate advantage. I have constantly seen her up to the present time, and, probably from the contraction of the scars, the apertures of the lids are increased but are still small. The face is also somewhat less, but it is still very full and deformed.—J. F. S.]

GULLIVER (*a*) mentions two peculiar affections of the cellular tissue which he has observed, and which he believes by no means uncommon among soldiers on service, who frequently "complain of inability to sustain the fatigue of marching, in consequence of swelling and pain in the feet and ankles, produced by this exercise. In many instances the cause of the affection is very obscure, and in some it may probably be ascribed to simulation; but I have seen cases in which the complaint was evidently connected with a change of structure in the subcutaneous cellular membrane of the legs, generally presenting itself in one of two forms.

"In the first and most numerous class of cases, after the patient has been long subjected to the inconvenience of swelling around the ankles and back of the feet, the disease assumes a more inveterate character,—that of thickening and induration of the subcutaneous cellular texture, so as to leave no further doubt of the incapacity of the man for active service. In one instance, in which the disease attacked the right leg, the part was

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(*a*) Remarks on certain Affections of the Cellular Tissue of the Legs; in Edinburgh Medical and Surgical Journal, vol. xlvi. 1836.

constantly bedewed with perspiration, emitting a peculiarly offensive odour. The affection sometimes occurs in both extremities, and frequently in one only.

"In the second description of cases, although the soldier assigns the same cause of disability as in the preceding, the anatomical character of the disease offers a marked difference. There appear simply to be induration and rigidity, without thickening of the subcutaneous cellular substance. I know of no specific term by which it could be appropriately designated. The lower part of the leg, and frequently the back of the foot, appears hide-bound, the limb feeling hard and smooth, from loss of extensibility in the filamentous web, which no longer possesses that yielding looseness necessary to the due performance of its functions, so that the smallest fold of the skin cannot be grasped between the thumb and finger. The affection is unattended by swelling, except incidentally from unusual exertion. The examples which have come to my knowledge have been invariably confined to one extremity. * * * Of the first, which, in its advanced stage, may be considered as a species of compact œdema, we find no account in the accurate Treatise of Dr. CRAIGIE, and only a doubtful notice by Dr. OTTO; of the second, I am unaware of any description." (p. 309.) "The chronic induration and thickening of the cellular substance may probably arise from a variety of causes, of which repeated attacks of erysipelas appear to be one; but the first two cases described in this paper, as well as others which I have seen, were not preceded by inflammatory symptoms. Nor was there any swelling or pain in the tract of the absorbing vessels." * * * It would appear merely conjectural to refer the affection to a change in the veins; but the following circumstances are worthy of remark in connexion with the subject,—viz., the examples of phlegmasia dolens, from inflamed veins; of œdema of the lower extremities, from the accumulation of clots in the veins of the limb, without their obvious inflammation, and of chronic œdema from the irregular congestion of the capillaries, without any discoverable alteration of the venous trunks during life.

"But we have no reason to suppose that the induration without thickening of the cellular substance is dependent on any change in the veins; and, until the precise anatomical character of the disease has been shown by dissection, the descriptive appellation should be admitted with reserve. From the unaltered size of the limb, it is difficult to ascribe the hide-bound condition of the part either to hypertrophy or atrophy of the cellular substance; for which reason it appears most probable that the affection is simply an induration or rigidity of this texture,—an effect probably of very slow inflammatory action, sometimes arising from local injury, and not unfrequently without any assignable cause." (pp. 311, 12.)

This latter form is very curious, and I believe entirely undescribed, nor does it readily admit of solution. The former kind seems to me very similar to the brawny condition above mentioned.—J. F. S.]

85. *Symptomatic pseudo-erysipelas* is distinguished from the *idiopathic* or *common* inflammation of the skin produced by irritation; the inflammatory redness is not so distinctly spread; at some little spots it is more intense, here and there inclining to violet; the affected part is less hot, more doughy, sometimes also hard and knotty, and often at the very beginning of the disease, distinctly fluctuating to the touch. The patient does not complain of such burning, but of a gnawing or beating pain, not proportioned to the degree of inflammation, and situated deeply in the limb. The swelling also bears no proportion to the degree of inflammation, but is in direct relation to the pain. Painful and knotty hardening of the skin frequently precedes its inflammation. When the inflammation has taken place, it always spreads farther, usually, however, more slow than quick, creeping, as it were, towards the affected parts. The ordinary means of resolution are of little use; in most cases, the disease is chronic, and single spots are often observed, which suddenly become more sunken, more or less distinctly fluctuating, mortified or destroyed in some way or other. All the external causes which could have given rise to ordinary inflammation of the skin are deficient also at the beginning of the disease.

86. The etiology of pseudo-erysipelas is clear from what has been already said of its several kinds. In reference to the necrotic hardening of the cellular tissue, which is the most usual cause of pseudo-erysipelas, it must

be remarked that, although its origin is in many cases obscure, yet a peculiar state of atmosphere, specially the operation of severe cold and a certain change of temperature, must contribute much to it. Hence this disease occurs more frequently in winter and in the coldest months, than at any other time of the year, more frequently in weakly people and on the lower limbs, more commonly in advanced age and in the male sex.

87. The *Treatment* of simple erysipelas requires especially action on the biliary and cutaneous systems. Emetics have generally here the best effect if employed early, and cannot be replaced by purgatives. If after their operation the fever continue, cooling acid purgatives with suitable antiphlogistic diet must be employed. Not until the fever has entirely or for the most part subsided and no further indication for depletory remedies exists, can sudorifics alone be relied on. Only if the erysipelas, especially on the face, be accompanied with high inflammatory fever, the head thereby attacked, the erysipelatous parts swollen, burning, and painful, accompanied with confusion and determination of blood to the head, should blood-letting or bleeding with leeches behind the ears be employed before the use of emetics, and at the same time the blood should be withdrawn from the head by warm foot-bathing, mustard poultices upon the calves of the legs, and so on. It is always, however, to be remembered, that erysipelas, even when connected with inflammatory fever, will not bear the same active antiphlogistic treatment as other inflammations, and is specially prone to return after any exhaustion.

[Two very different plans of constitutionally treating erysipelas are employed in this country, and, curious as it may appear to be, with success. The old method, still largely practised, is that on the antiphlogistic plan, first clearing the bowels, and then employing salines and antimonials; and, when the inflammatory action has subsided, administering gentle tonics, as tincture of calumba and the like. This treatment, which formerly I have seen constantly practised, and to which I have been personally, often in my youth, subjected, was generally very successful, and is, by many practitioners, still considered the best. The second mode is directly the reverse, and was, I believe, first introduced, fifteen or twenty years since, by my friend and colleague, Dr. WILLIAMS. It consists in the entire reliance on wine (port wine usually) given often to the amount of eight and twelve ounces a day, varying according to the age and condition of the patient's constitution, but without any consideration of the stage of the disease. And this practice has certainly been very successful, and is at our hospital now almost invariably followed. I prefer, if the case come under my care early, besides administering a dose of calomel and rhubarb, (which should never, under any circumstances, be omitted,) to give some saline and antimonial for twenty-four hours; rarely beyond that time do I defer giving the wine, the effect of which in checking the progress of the erysipelas is, generally, soon very decided. Bleeding, either from the arm or by leeches from the head, is, I believe, very unadvisable. The disease almost invariably occurs in constitutions without power, and therefore bleeding favours rather than diminishes it.—J. F. S.]

88. The *Local Treatment* of true erysipelas has no other object than to defend the diseased part against external injury, which may be effected by the use of dry warmth, by bags of camomile and elder flowers, by warm flannels, and so on. All moist, especially wet or greasy remedies, are injurious, as they repel the erysipelas, or produce œdematous swelling of the part. If, after the fever and swelling have for the most part ceased, there remains an œdematous, colourless swelling, the herb bag must be smeared with camphor, or the swelling covered with green-oil cloth, and swathing of the part made use of. According to RUST, only the vesicular erysipelas and its varieties, especially if they exhibit a more chronic than acute course, require the application of moist warmth in a proper vehicle, for which purpose GOULARD's lead wash with a small addition

of laudanum is best. If the erysipelas run into ulceration or gangrene, attentión must be paid to giving free escape to the ichor; the general and local treatment must be regulated, as before mentioned, according to the character of the fever, and the rules given in reference to abscess and gangrene, and clearance of the bowels, must be especially remembered.

[The local treatment of erysipelas is very simple; warm or cold washes, as may be most agreeable to the patient's feelings, consisting of water with a little spirits of wine, are best, and I think preferable to either warm or cold lead wash, which renders the cuticle harsh and unyielding.

If there be much tension of the skin, the practice recommmended by Dobson of making a dozen or twenty punctures with the point of a lancet is very beneficial, and agreeably relieves the hide-bound sensation which the patient feels.—J. F. S.]

89. In *idiopathic erysipelas* the treatment must be guided according to the degree of the inflammation. General antiphlogistic treatment is rarely necessary in this case; usually the application of leeches and of cold water or lead wash are sufficient for resolution.

[Leeches should never, under any circumstances, be applied locally, as the irritation resulting from their use itself frequently excites erysipelas or rather erythema. If absolutely requisite, puncture with the lancet is to be employed.—J. F. S.]

90. In *erythema consensuale* the treatment varies according to its original cause. If it depend on the tension of aponeurotic expansions, incisions, warm bathing, friction with mercurial ointment, warm fomentations and poultices must be applied. If the erysipelas appears only as a reflection of deeper disease of the periosteum, of the tendons, or of cellular tissue, so long as the disease continues purely inflammatory, abstraction of blood, leeching, applications of cold lead wash and free mercurial friction, and, in metastasis especially, mercurial laxatives and warm aromatic fomentations, must be used; in gastric symptoms, with loaded tongue, heartburn and the like, a vomit should be first given, by which principally the course of the disease is rendered less severe. But, if gangrene or ulceration have occurred in the deeper parts, and there appear a spot particularly discoloured or fluctuating, it must be opened and the wound dilated with the blunt-ended bistoury upon the finger in every direction where the destruction of the cellular tissue has occurred, in order to discharge the pent-up ichor and the often large pieces of completely dead cellular tissue. The further treatment consists in supporting nature to throw off the destroyed parts, to sustain the sinking powers, and to produce good suppuration. According to Rust, there may be applied locally bark, camphor, myrrh, charcoal, camomile flowers, turpentine oil, camphorated spirit, pyroligneous acid, spirituous aromatic fomentations, and so on; internally, powerful tonic remedies are to be used in connexion with mineral acids, and, if thereby a good suppuration is produced, the healing may be aided by the application of a moderately compressing bandage. I have, however, noticed, that under this stimulating local treatment, the destruction and unhealthy suppuration as well as the general irritation have increased, and that by the use of warm fomentations and a suitable general treatment improvement has been much more quickly produced; I, therefore, only use warm applications locally. In great hardening of the skin and of the underlying cellular tissue, I have always effected a perfect resolution by mercurial infriction and malt baths.

[Neither leeches, cold washes, nor mercurial friction are, according to my experience, of any material advantage, and therefore hurtful, as causing waste of time. The best local treatment, and which I almost invariably adopt, is, when the skin is tense, shining, and deep red, to make several incisions, according to the extent of the disease, from an inch and a half to three inches in length, which I think preferable to very long cuts, just through the skin into the cellular tissue, which should be so disposed that every four should have interposed between them a sort of diamond-like space, and thus, when several cuts are made, the skin has a net-like appearance, and yields in every possible direction. The object is not to obtain blood, which, indeed, I generally endeavour to avoid by bathing for a few minutes with cold water, if there be any disposition to bleeding, but to allow the cells of the cellular tissue to empty themselves of the fluid with which they are loaded, the effect of which is, that the skin, being further relieved of tension, is less likely to slough, and the tissue itself being no longer squeezed by the effused serum, the blood passes freely through its capillary vessels, and its life is preserved, instead of it becoming strangulated. If the tension be not sufficiently relieved, or if the disease be continued up the limb, it will be necessary to make additional cuts from day to day, which is the only chance we have, that I am aware of, to prevent the death of the cellular tissue, and it each time relieves the patient's sufferings most remarkably. In one instance of a man who had inflammation of the cellular tissue of the back of the hand, resulting from a strain, and which travelled up to the chest, I made about thirty cuts, mostly three inches in length each; during the course of the week, nearly the whole cellular tissue of the arm sloughed; but he completely recovered, his arm, however, closely resembling a piece of scored pork.

In these cases brandy, wine, porter, general good feeding, and humouring the appetite, are absolutely necessary, and infinitely preferable to medicine, which should be restricted to an opiate, or an occasional dose of castor oil, as needed.—J. F. S.]

91. In the treatment of the various kinds of erysipelas, we have given the treatment proper for each, and which has been proved by experience. The opinions, however, of the most distinguished physicians differ from each other in many important points on this subject. Thus the incisions should only be made in pseudo-erysipelas, and of the suitable length and depth, according to Rust, Dupuytren and Lawrence; while, according to Hutchison (*a*), they should be made early and in considerable numbers; but Dobson (*b*) employs numerous punctures with a lancet in all kinds of erysipelas and on all parts of the body. In pseudo-erysipelas Dupuytren (*c*) professes, in some cases, to have effected a satisfactory resolution by blistering the diseased part: he, however, considers this remedy as doubtful, as in other cases he noticed deterioration and sloughs occurring after its use. But, in all cases of common erysipelas, if the tongue be moist and little red, the skin moderately hot, and slight general reaction connected with the local inflammation, he considers the suppuration produced by one or more blisters upon the inflamed part as the best mode of effecting resolution. Some (*d*) would arrest the extension by the application of a blister at the margin of the erysipelas; but others (*e*) entirely reject their use. Bretonneau (*f*) and Velpeau (*g*) have had the happiest results from moderate compression of a limb attacked with inflammation, even when the transition to suppuration seemed unavoidable and all other remedies had failed. Lawrence and Duncan have, on the contrary, observed bad effects resulting from this practice (*h*).

[Another mode of attempting to check the spread of erysipelas, is that of enclosing it, if small, within a space bounded by a belt, a quarter or half an inch wide, made on the skin with nitrate of silver; or, if a limb be affected, by gartering it in the same way

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(*a*) Case of Erysipelas, with Remarks; in Med.-Chir. Trans., vol. xiv. p. 213.

(*b*) On Treatment of Erysipelas by Punctures; in Med.-Chir. Trans., vol. xiv. p. 206.

(*c*) Dupuytren, as above, p. 322. Olivet, Thèse, de l'Erysipèle Phlegmoneux, p. 30.

(*d*) Roche et Sanson, Nouveaux Elémens de Pathologie Medico-Chirurgicale, vol. i. p. 352. Lawrence, as above, p. 63.

(*e*) Rayer, Traité des Maladies de la Peau, p. 125.

(*f*) Sur l'Utilité de la Compression dans les Inflammations Idiopathiques de la Peau. Par., 1815.

(*g*) Mémoire sur l'emploi du Bandage Compressif dans le Traitement de l'Erysipèle Phlegmoneux, de la Brûlure et des plusieurs autres inflammations aiguës des membres; in Archives Générales de Médecine, Juin, 1826, p. 192.

(*h*) Lawrence, as above.

with the nitrate of silver some inches above. I have sometimes seen the erysipelas extend up to the belt and there stop; at other times I have observed it move on without having met with any check. I am therefore doubtful of the efficiency of the nitrate of silver; but, if used, it should be carefully applied, even to blistering the skin, otherwise it is certainly useless.—J. F. S.]

92. As various also are the opinions as to erysipelas consequent on wounds, (*Erysipelas traumaticum,*) in which the most opposite fomentations, blisters, incisions and scarifications, cauterization with the red-hot iron, (Larrey,) antiphlogistic treatment, emetics, and so on, have been recommended. If the above-described different kinds of erysipelas and pseudo-erysipelas be borne in mind, and, if it be remembered that the traumatic erysipelas, which in four or five days accompanies wounds, is produced by different causes, as too great irritation of the wound by improper bandaging, foreign bodies, the application of greasy, too stimulating or too hot softening remedies, cold moist air, a bruised and torn condition of the wounded part, wounds of fibrous structures, gastro-biliary affections, mental excitement, improper food, and the like, it may be easily perceived, how a proper observation of the various causes can alone prevent a merely routine treatment of so important a disease (*a*).

II.—OF BURNS.

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93. *Burns* (*Combustiones, Ambustiones,* Lat.; *Verbrennungen,* Germ.; *Brûlures,* Fr.) are produced by fire or heated substances touching our bodies. The action of caustic substances, especially of the concentrated mineral acids, corresponds precisely with that of fire. According to the degree of heat, in fluids therefore according to their consistence and capacity for heat, according to the duration of the contact and the delicacy of the part touched, different degrees of burns are produced, which may be thus distinguished: 1. *as superficial inflammation* (*Erythema;*) 2. *as more*

(*a*) Compare Larrey, Clinique Chirurgicale, vol. i. p. 21; Balling as above.

severe inflammation with rising of the cuticle into blisters (Vesication ;) 3. *more deeply penetrating, higher inflammation, with the destruction of the cuticle and of the mucous net;* 4. *gangrenous destruction at different parts and to various depths.*

Degrees of burns are variously distinguished, as they are considered not merely as to their intensity, but also with reference to their spreading into deeper parts. Many point out but three degrees. DUPUYTREN has described six; of which the latter, however, only differ in proportion as the gangrenous destruction is more or less deep, or involves the whole bulk of the limb. The four above-mentioned degrees are based on the corresponding steps of inflammation, viz., the erythematous, exudative-inflammatory-vesicular, the phlegmono-suppurative and gangreno-sphacelous. According to the variety of causes producing burns are these degrees of burning frequently blended with each other; for instance, in burns with hot fluids.

94. The *first degree* of burn, arising from hot vapour, from the momentary or lengthened touch of a more or less hot body, produces a bright uncircumscribed redness of the skin, as in erysipelas, which for the moment disapppears on pressure of the finger, without swelling, and is accompanied only with increased turgescences of the skin and a little pain. Febrile action only sets in if this degree of burn be much spread and in sensitive persons. The redness of the skin either disappears after some hours or days, when the cuticle scales off.

95. In the *second degree*, which is most commonly produced by hot fluids, the cuticle rises either at once or gradually into larger or smaller blisters, filled with clear or yellowish fluid, the redness and swelling of the skin is more distinct; the pain severe, burning; and, according to the degree of these appearances and the extent of the burn, do febrile symptoms set in. These blisters either shrivel together and dry, the fluid being absorbed and the skin thrown off, or, if they burst and are opened, the fluid is discharged, the blister falls together, dries, and after some days either a new cuticle is produced or the exposed part suppurates. The healing leaves no scar.

96. The *third degree* of burn is usually produced by the flame of fire or by the lengthened touch of hot bodies, especially of hot fluids, and is characterized by gray, yellowish, or brown spots, which are thin and soft, insensible to light pressure, but are painful if the pressure be increased; at the same time generally appear blisters full of brownish or bloody fluid; the surrounding parts are very red and much swollen. The general reaction corresponds to the degree of the inflammation. After six or eight days, and frequently later, the remains of the destroyed cuticle and mucous net are thrown off, and the cure is effected by granulations and the formation of a white glossy scar.

97. In the *fourth degree* of burn the destruction penetrates either through the entire thickness of the skin and cellular tissue, or deeper into and through the muscles to the bone, or the whole part is destroyed and charred. This degree is produced by long contact with fire, red hot or molten metals, boiling fluids. The sloughs differ in thickness, are completely insensible; soft, gray, or yellow if produced by hot fluids; brown or black, dry, hard, and sounding when struck, if caused by fire or dry hot bodies. In the immediate neighbourhood of these sloughs the skin is drawn into radiating folds; the surrounding parts are extremely red and swollen, very painful, and frequently beset with blisters. The slough is thrown off by the suppuration which takes place around it, and a more or less deep suppurating space is produced, which commonly has a

much larger extent than the slough, because in consequence of the severe inflammation its immediate belt is destroyed by gangrene. The granulations most usually are developed very quickly and luxuriantly, the edges quickly draw together, and shapeless, hard, contracted, tough scars are produced, whereby the direction and motion of the part is often changed and impeded, and the latter even perfectly destroyed. After the throwing off of a part which has been entirely charred, a more or less uneven stump is produced.

98. More or less severe symptoms ensue according to the different degree and extent of the burn, according to the importance of the burnt part, and the constitution of the patient, and not merely does the degree, but also the extent of the burn, determine its danger. In the first two degrees the inflammation is easily resolved, and only if it affects a large extent of the body, and still more in the higher degrees, does febrile reaction set in, when, on account of the disturbed functions of the skin and the changed relations between the external and internal skin, the mucous membrane of the intestines is quickly affected, and uneasiness, loss of sleep red dry tongue, nausea, vomiting, high nervous excitement, delirium, and the like come on. From the severity of the pain cramps and convulsions occur, especially in sensitive persons. In extensive burns death may ensue rather suddenly from the greatness of the pain, from the quick stopping of the functions of the skin, from the excessive flow of blood to the internal parts where on dissection either no internal derangement is seen, or where a gorging of the brain and mucous membranes with blood and even effusion into their cavities is observed ; or from the severity of the fever, especially if accompanied with inflammation of internal parts, of the stomach intestines, brain, more rarely of the lungs and of the pericardium ; or from the very copious and continued suppuration, by which the powers are exhausted. The production of unsightly hard scars, or the growing together of neighbouring parts, may cause disturbance or complete stoppage of their functions.

[Burns, from whatever cause, are generally more dangerous than scalds, as they are rarely unattended with destruction of the skin and subjacent parts, whilst, on the contrary, scalds more usually produce only vesication. If, however, a person be completely immersed in boiling water, even for two or three minutes, of which I once saw a frightful instance, of a dyer who fell into his copper, he will be destroyed in ten or fifteen minutes. But I have several times, on the contrary, seen persons, whose entire surface has been charred by fire, live for many hours. This remarkable difference may, perhaps, be accounted for by presuming that the hot water, passing through the mouth and nostrils into the pharynx, causes speedy effusion into the loose cellular tissue connecting the skin with the laryngeal cartilages, and so, by narrowing and closing up the aperture of the windpipe, producing suffocation.

Both burns and scalds, however, are dangerous, more in reference to the part which they attack, than the extent of surface they injure; thus, scalds or burns on the chest and belly especially are far more dangerous than on the limbs, although the injured part be twice or thrice as extensive; and children who are burnt or scalded on the chest most commonly die in two or three days after the accident; in a few instances they may live a week, but they rarely ever recover. I recollect only a single instance of recovery, after severe burn on the trunk, in a child about six years old, in whom the whole front of the belly and flanks were burnt and a considerable part of the skin destroyed. I do not recollect to have observed convulsions in these severe cases, as mentioned by our author and other writers; but, if they be fatal in a few hours, the patient generally, almost at once, drops into a state of stupor from which he never after rouses; and examination after death shows the brain loaded with blood, or, if life be prolonged, effusion of serum is observed on the membranes, and in the cavities of the brain, and, less commonly, also in the serous bags of the chest.—J. F. S.]

99. The slighter degrees of burn require merely the application of cold water, or the dipping the part in cold water; all other of the prescribed remedies, lead wash and so on, act only by their coldness. If fever be present the internal use of antiphlogistic remedies and a suitable diet must be combined with the local treatment. If the cuticle have been raised into blisters, they should be opened with a fine lancet, without removing the skin, so that the contained fluid may escape. If they be small, they often, under the use of cold, fall together and dry. If the part be deprived of its cuticle, generally it will not bear the cold application, which irritates, and increases the pain; but simple, mild, soothing remedies, mucilaginous, mild poultices or fomentations, a liniment of pure oil and yolk of egg, fresh butter, and other mild salves may be spread on pieces of soft linen, which should be applied over the burnt part, and often changed, or they should be frequently sprinkled with the remedies, to prevent their drying and sticking, so as to soften and cool by their frequent renewal. Cold is always to be applied to the neighbourhood of the parts deprived of their cuticle. When suppuration is established, and the extreme sensibility of the affected part reduced by the use of mild remedies, astringent and drying applications are to be gradually had recourse to: linseed oil, with lime water, zinc ointment, and so on. Lead ointment is said to produce ugly ill-shapen scars, which, however, I have not observed. If much proud flesh occur, it must be kept down with nitrate of silver. If mortification be produced at the instant of the burning, cold application, or, if the parts are very sensitive on account of the destruction of the cuticle, merely softening and soothing applications must be used till the slough is thrown off by the suppuration, when the remedies aforesaid must be employed. Sloughing rarely extends in this case, if not accompanied by deterioration of the juices. In other respects its treatment, even when resulting from the inflammation depending on the burn, is to be after the same general rules laid down for gangrene.

The remedies especially recommended for burns are very various, and in part completely contrary to each other in their operation. 1. Popular remedies, such as poultices of scraped potato, apples, moist earth, and so on, which are cooling by their proper renewal. 2. Applications of spirituous fluids, æther, alcohol, brandy and so on, if used cold, act also coolingly by quick evaporation; if warm, they can only act as counter irritants: but all burns in which the *rete cutaneum* is exposed must be protected from irritation. 3. The burnt part is brought near to the fire immediately after the burning. 4. Wraps, by which the burnt parts are kept perfectly closed against external influences. The overlaying of fine cotton or wadding, to be kept moderately tight with bandages till it falls off. If blisters are present, they must be first punctured. The strewing with flour and bandaging with dry linen. If pain recur, the linen should be removed and the flouring repeated again and again till it is a quarter or half an inch thick. In very severe burns, after a fortnight, a fourth of calamine powder is added to the flour and applied moist. Covering with chalk, smearing with amber-varnish or tragacanth mucilage spread on blotting paper or fine linen. The watery solution of lunar caustic, recommended by FRICKE, operates in a similar way, by defending the sensitive surface and furnishing it with a covering beneath which speedy healing takes place. In like manner is the operation of kreosote to be explained, from which, when diluted with water, or mixed with grease as a salve, I have frequently observed the best consequences. 5. Various ointments for burns, consisting of fat, butter, wax, cream, and the like. LARREY forbids all cold and cooling remedies, and uses saffron ointment and ointment of styrax. 6. Solution of chlorate of lime, wherewith the bandage is to be frequently moistened during the day, causes a slight itching for about ten minutes, and is, according to LISFRANC, useful in slight degrees of burn, producing new skin in twenty-four hours; in higher degrees the suppuration is diminished and improved.

Much difference of opinion has existed and still exists among English surgeons, as to the choice of remedies for burns and scalds. Whilst some prefer moist applications, cold or warm, either as washes or liniments and ointments, others advocate the use of dry substances, as cotton or flour and the like. I shall first mention some of the more prevalent plans of treatment, and afterwards describe my own ordinary practice, without, however, claiming for it any great degree of originality.

James Earle was the principal supporter of cold moist applications in form of very cold water or even ice, pounded and applied on clothes or in a bladder. Hunter observes:—"Cold lessens all inflammations, and is a very good application where it can be applied; but it cannot be applied so universally as others. However, cold has this disadvantage, that the pain, although removed while under the application, occurs with double force when it is removed, much more than from any of the applications; and the reason is evident, for, as the warmth returns, the pain is increased by the warmth, even in sound parts." (p. 218.) Henry Earle (*a*), also, although he advocates both cold and warm applications on certain conditions, notices the objections which exist in reference to the use of cold, at the same time that he mentions its advantages. He says:—"The advantages of the plan (the application of cold) are, that it may generally be resorted to without delay, and that it has the effect of affording immediate relief. The disadvantages attending it are, it is necessary to continue or renew the application of cold for a considerable time, as the heat and pain will return, unless the diminished temperature be steadily maintained. On this account it is that, in certain delicate constitutions, and especially when the injury extends to the chest or trunk, this cooling plan of treatment cannot be employed without risk. (p. 301.)

The treatment recommended by Kentish (*b*), and consisting of the primary application of warm and stimulating remedies, is generally practised in the coal districts of the North of England, and therefore, if for no other reason than that it has been there found successful, is well entitled to notice. I have had a little experience of its effects, and do not think it less advantageous than most other plans of incipient treatment, which is the principal point of difference in the practice. Kentish's theory of the treatment of burns and scalds is founded on the mode of treating frost-bite, the very reverse of which he considers, with a fair show of reason, is here indicated. Nor are his views to be set down as "visionary, as amusing the fancy, but never capable of improving the judgment;" nor are they "nearly unintelligible, nor unsupported by any sort of rational evidence," as they have been asserted to be by Samuel Cooper. The question "the effects of heat above the freezing point, carried to the extent of what is termed burning," being the converse of its effects "below the freezing point, commonly called the effects of cold," it will be, on the whole, more convenient to leave the discussion of till we treat of frost-bite.

Kentish's object consists in "restoring the unity of action," as he calls it, in these "local injuries from increased action," * * * *first*, by gradually diminishing the excitement or action of the part; and, *secondly*, by increasing the action of the system to meet the increased action of the part; holding this law of the system in view, *that any part of the system having its action increased to a very high degree, must continue to be excited, though in a less degree, either by the stimulus which caused the increased action, or some other having the nearest similarity to it, until, by degrees, the extraordinary action subsides into the healthy action of the part.*" With this view, holding the part to the fire seems the best mode of relief; but, as parts of the body are injured where this cannot be done, the most stimulant applications must be had recourse to; for, in this class there is little fear of any of them being greater than that which originally caused the accident; the strongest rectified spirits made still stronger by essential oils; add to which they may be heated as much as can be suffered on the sound parts; these, and many more applications of the same class will give the speediest and most effectual relief. These are only to be continued for a certain time, otherwise they may afterwards cause the very ill they were given to cure; and should be succeeded by less stimulant applications, until the parts act by the common natural stimuli. The internal mode of relief will be to give those substances which soonest excite the system to great action, such as æther, ardent spirits, opium, wine, &c., by which means the solution of continuity of action is allowed to continue the shortest time possible, and the unity of action restored, which constitutes the cure." (pp. 112–14.)

The mode in which Kentish sets about the primary dressing of burns is as follows:—

"Take a teacup and put some of the best rectified spirit of wine, or spirit of wine with camphor, or spirit of turpentine, into it; then place it in a basin of hot water, so as to heat it to what you can bear with your finger; then, by means of a rag dipped in this, or a probe armed with a good deal of lint, wash and bathe the whole of the injured sur-

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(*a*) Clinical Lecture on Burns; in Medical Gazette, vol. v. 1830.

(*b*) On Burns, &c.

face, which when done two or three times over, apply plasters to the whole, formed in the following manner:—Take of the common yellow basilicon, *ung. resinæ flavæ*, according to the occasion; let it be mixed up with as much spirit of turpentine as it will take to make it of the consistence of a liniment, which, when spread upon thin oiled cloth, is to be applied to the part: the wax and oil of the basilicon will fill up the pores of the cloth so as to prevent evaporation, by which means the strong stimulant powers of the turpentine, or alcohol, or camphor, or all together, are so confined upon the surface as to excite the absorbents to the very increased action we wish; and, when this has taken place, the small quantity of oil is sufficient to preserve the cuticle in a pleasant state." (p. 132.)

KENTISH disapproves of frequent dressings; "for the very quick evaporation that takes place on exposing or uncovering the surface any time during the first four-and-twenty hours is pernicious; I therefore only dress the patient once a day even at first, unless in some instances. * * * But it will be better to allow him to remain for the first twenty-four hours without being disturbed; if the plasters are spread tolerably thick with the ointment, there will be no need of using any further means till the next dressing." The parts are to be exposed to the air as little as possible, and therefore the plasters are to be prepared before the dressing is commenced. The heated pure spirit is generally not again required; therefore, at the second dressing, the redness or seeming inflammation appearing less vivid, "proof spirit or laudanum with the coldness taken off, will be sufficient for this dressing, and the plasters immediately applied." Within the next twenty-four hours, "generally the appearance of inflammation has disappeared, and where there had been any small vesication in the first instance, there will be seen such a secretion of pus as may be noticed the second day after the application of a blister; the stimulants will now have performed their office, and, if continued on, they will produce unpleasant effects themselves, somewhat resembling the complaint they were meant to cure. * * * For which reason, as the equilibrium of action will appear nearly to be restored, it will now be necessary to apply less irritating substances; therefore, instead of basilicon made into a liniment with spirit of turpentine, it may be rendered into a proper consistence with camphorated oil; should even this be too strong and any appearance of irritation take place, the cerate with *lapis calaminaris* or GOULARD'S cerate, will answer every purpose, and abate any irritation that may have arisen from the former applications. What I have found very effectual in such cases, is an ointment made with the addition of a scruple of flowers (oxyd) of zinc to an ounce of the white ointment, *ung. ceræ*; this, continued until the part heals, is in general sufficient; but, if the skin should, after healing, remain very tender and likely to crack, a liniment formed of lime water and linseed oil would be useful. I have frequently found much advantage from camphorated oil in this stage. These means properly attended to, and keeping the tender skin covered from the too great action of the external air, I have found effectual in curing, and quickly restoring the cuticle to a healthy state, after most severe cases." (pp. 133–36.)

Raw cotton has of late years been used in America. GIBSON (*a*) says:—"The best application I have ever tried is *raw cotton*, thinly spread out or carded, and laid directly over the burn. The value of this remedy was ascertained accidentally, a few years ago, (previous to 1824,) by a lady living in Hartford County, Maryland, whose child was scalded by boiling water, nearly over its whole body. The mother was carding cotton, in an adjoining room, at the time of the accident, and, having no medical assistance within reach, undressed the child as quickly as possible, and covered the whole burned surface with masses of the cotton. The effect was wonderful; for the child soon became perfectly quiet, fell asleep, and, upon removing the cotton, a few hours afterwards, no inflammation whatever could be perceived. Dr. DALLAM (*b*), to whom we are indebted for an account of this case, has furnished others of a similar character, in which the cotton proved equally efficacious, and my own experience enables me to confirm his statement of its usefulness. It is only, however, in the superficial burn that this remedy can be relied on. (p. 51.)

Dr. ANDERSON (*c*) is a strong supporter of the use of cotton in burns; he says:—"The utility of cotton is most conspicuous in simply vesicated burns, where one or at most two renewals of it are sufficient; and it is to these cases that I believe its application has generally been restricted. But I have used it in a great variety of cases, recent and old, vesicated and sphacelated. From the state of the parts after a deep burn, the

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(*a*) The Institutes and Practice of Surgery, being an Outline of a Course of Lectures. Philadelphia, 1838. 5th Edition.

(*b*) On the Use of Cotton in Burns; in POTTER'S Medical Lyceum, p. 22.

(*c*) On the Treatment of Burns; in Glasgow Medical Journal, vol. i. 1828. 8vo.

cotton generally requires renewal about every six or eight days, until the sloughs have long separated and the discharge has been diminished. The comfort enjoyed during such intervals should go far to recommend this practice, even if, in other respects, it had no advantage over that by a daily renewal of the dressings. But I am now quite satisfied that a persevering use of this remedy, even in the chronic state of burns, and in many other ulcerations, is in every respects preferable to the practice usually adopted. (p. 211.) Some care is necessary, both in preparing and in applying the cotton. For this purpose it should be finely carded, and disposed in narrow fleeces, so thin as to be translucent, by which means it can be closely applied in successive layers, and is thus made to fill up and protect the most irregular surfaces. The burnt parts, if vesicated, are to be washed with tepid water, and the fluid evacuated by small punctures; or, if more deeply scorched, they may be bathed with a spirituous or turpentine lotion. The cotton is then applied, layer after layer, until the whole surface is not only covered, but protected at every point, so that pressure and motion may give no uneasiness. On some parts it will adhere without a bandage, especially when there is much discharge; but, in general, a support of this kind is useful. Where the vesications have been broken, and the skin is abraded, or where there is sphacelus, more or less suppuration always ensues, and in such cases the discharge may be so great as to soak through the cotton and become offensive, particularly in summer; so that it may be necessary to remove the soiled portions. This, however, should be done as sparingly as possible, taking care to avoid uncovering or disturbing the tender surface. (pp. 213, 214.)

"There appears," Anderson further observes, "to be a twofold effect from this kind of treatment. The primary effect arises from the exclusion of the air and the slow conducting power of cotton, by which the heat of the part is retained, whilst a soft and uniformly elastic protection from pressure is afforded. The secondary effect depends entirely on the sheath or case formed by the cotton absorbing the effused serum or pus, and giving the best possible substitute for the lost cuticle. But, in order that the full benefit may be derived from this substitute, and to ensure an equable and continued support to the tender parts until the new skin is formed, it is absolutely necessary that this new or *cotton cuticle*, as it may be called, should not be removed except under particular circumstances, until the real cuticle is sufficiently formed to bear exposure. (pp. 217, 218.)

The use of flour as an application for burns was, I believe, first recommended by Dr. Ward (*a*), formerly one of the surgeons of the Manchester Infirmary, who appears to have employed it accidentally at first; for, finding a young woman who had been scalded from the elbow to the fingers' ends, screaming with pain and shivering as if in the cold stage of an intermittent whilst her mistress was rubbing in goose grease, preparatory to the application of scraped potato, he absorbed the grease with soft linen, and then with a flour-dredger, which happened to be at hand, sprinkled the scalded parts as completely and expeditiously as he could, which almost immediately and entirely relieved the pain. The same application was used by Ward in several other cases (p. 619.) His mode of proceeding he thus describes:—"The first object will be, (after having laid the patient upon a bed or sofa,) without a moment's loss of time, to take off the clothes and apply bread flour, by means of a common kitchen dredger, plentifully, and as expeditiously as possible, to the whole of the burned or scalded surface, and this being properly and sufficiently done, carefully applying clean dry linen cloths immediately over the flour, and such bed-clothes or other coverings as may be required to keep the patient comfortably warm, but not too hot." He strongly advises "avoiding the application of liquids of whatever kind, including oil, and liniments, ointment, and salves containing oil, all of which are extremely pernicious." If the pain be removed by this first application, it is advisable that the patient should go to sleep, even though he have no nourishment. "If pain return we must commence by removing the linen coverings or bandages from those parts where the pain is the most considerable, without attempting to remove any of the flour previously applied, except such portions as do not adhere, and then proceed as before to apply flour equally and copiously to the painful parts, by means of the dredge, which is the easiest and best method of effecting it. * * * It would also be a good general rule, particularly at the first and several of the succeeding dredgings or sprinklings, to continue the process for a certain time (longer or shorter, according to the extent of the violence, and the degree of pain complained of) after the parts become easy, (with a view to keep them in that state as long as possible,) and steadily to persevere in it either until the last-mentioned object be attained, or the parts affected shall have received a coating or covering of this invaluable article of from a quarter to nearly half an inch in thickness, and then apply

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(*a*) A New Method of Treating Scalds and Burns. Two Papers; in Lancet, vol. ii. 1828.

the bandages, as before: and, secondly, not to disturb those places which still continue easy in consequence of having undergone one or more sprinklings or dustings, until the return of pain or uneasiness shall indicate the necessity of repeating it. And, in this manner we must proceed the first two or three weeks, or until that period shall arrive when it will be necessary to make some addition to the flour." (p. 176.) This addition consists of one portion of calamine powder to three of flour, gradually increasing the calamine till the proportions are equal, and then by degrees diminishing the flour till the calamine alone is applied, except some calamine ointment with an increased quantity of the earth, spread very thinly on linen, and laid over the powder. A moderate diet is allowed, commencing first with milk, puddings, broth, and soup. Medicines are to be used sparingly; but, if sleep cannot be obtained, then opiates,—Dover's powder, perhaps, in preference to laudanum, in proper doses every four or six hours, rather than one large dose; or an opiate friction on any uninjured but sufficiently extensive part to be effectual. Ward's explanation of the *modus operandi* of flour is, "that, by its instantaneous operation as an absorbent powder, in allaying the irritation, and partly by its coldness diminishing the temperature of the inflamed parts, it immediately arrests the rapid progress of the inflammation, and forms a fit medium or covering to prevent the access of the atmospheric air to a part of the body which is at all times peculiarly susceptible of its action (especially upon a large and extended surface of it) but which is now rendered a thousand times more susceptible than before.

Marshall (*a*) makes the following observations on the *modus curandi* of the remedy:—"This mild substance," says he, "is doubtless pre-eminent to all others hitherto in use, by imparting immediate ease to the inflamed and irritable surface; it rapidly heals by the scabbing process, in uniting with the discharge from the abraded cutis; and almost instantaneously forms a temporary semi-transparent covering, thereby assisting the natural functions in restoring the epidermis. The advantage becomes evident by stopping a profuse discharge, and the tedious progress of ulceration. That remarkable substance the animal (vegetable?) gluten, peculiarly contained in wheat, seems, in this instance, to assist the rapid regeneration of the scarf-skin, and thus protects the *cutis* and *rete mucosum*. The surface of the body being wonderfully supplied by the extension of the cutaneous nerves, in the form of a soft pulpy membrane, somewhat resembling the expansion of the optic nerve on the retina, readily affords, it is presumed, an explanation of the great violence offered to the system in all cases of extensive burn or scald. The topical remedy is equally suitable to either of these accidents, and perhaps, eventually, will be found useful in many other cutaneous affections. * * * When the flour has formed the artificial covering, the further application becomes comparatively superfluous, which is perceived by its rolling off." (p. 298.) Beyond a single slight case, which did very well, I have no personal knowledge of the effects of flour; but I know some of my friends think it a good application.—J. F. S.

On the primary treatment of these accidents Hunter says:—"Whatever will abate inflammation arising from accident, will have the same effect upon a scald or burn; and, from the diversities of applications, we have opportunities of knowing the best. Oil was long an application, but which has no virtue; spirits have also been long applied, and with very good effect. The common application, which is a soap made with lime water and oil, seemed to answer better; and now vinegar (*b*) is strongly recommended, and I think with justice as far as I have seen." (p. 218.) The best secondary treatment Hunter considers to be that by scabbing, of which he says, "the mode of assisting the cure of wounds by permitting a scab to form, is likewise applicable, in some cases, to that species of accident where the parts have not only been lacerated, but deprived of life." And then observes:—"This practice is the very best for burns or scalds, after the inflammation has either been considerably prevented, or subdued, by proper applications or by time, for which there probably are more remedies than for an inflammation arising from any other cause, as if there was something specific in such causes." (p. 217.)

The two French surgeons, Bretonneau of Tours and Velpeau, who have been already cursorily noticed as employing pressure in pseudo-erysipelas, have also recommended it in the treatment of burns. Bretonneau (*c*) advises the application of circular bandages, either dry or moistened with a discutient or narcotic wash, the vesicles, if any, having been emptied by one or more punctures. He considers that the pressure, besides preventing exhalation of the serosity, keeps the cuticle on the *rete mucosum*, and thus

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(*a*) On the Treatment of Burns; in London Medical and Physical Journal. New Series, vol. vi. 1829.

(*b*) This was Cleghorn, the Edinburgh Brewer's Treatment; for which see his Account of a Method of Curing Burns and Scalds, in three Letters to John Hunter; in Medical Tracts and Observations, vol. ii. London, 1792.

(*c*) Already quoted, *par.* 91, p. 108.

protects it from the air and external agents. But, if the burnt part be stripped of its skin, oiled silk carefully fitted is to be first applied. VELPEAU (*a*) recommends strongly the employment of compression in burns, by the application of diachylon plaster spread on strips of cloth, although he very candidly admits that further experience is yet requisite to perfect this mode of cure. He lays great stress on the composition of the plaster; that it should contain neither too large a proportion of grease nor of diachylon, but that there should be a pretty large quantity of litharge, and that it should be of a softish consistence, as the effect is produced not merely by the compression, but varies according to the composition of the plaster." (p. 187.) Adopting the four degrees of burns mentioned by our author, VELPEAU says that—

"1. In those of the first degree characterised, by erythema or even tumefaction, with itching or slight pain, all modes of treatment succeed, and that it is not, therefore, in this case he hopes particularly to recommend his own. 2. That, in those of the second degree, characterised by the coming off of the epidermis or phlyctænæ, without alteration of the mucous body, the effect of the straps shows better. 3. That, in those of the third degree, that is to say, those where the mucous net-work has been partially destroyed, and in those of the fourth degree, where the skin is completely converted into eschar, his mode of treatment is almost indispensable." And he then proceeds:—"In burns of the first degree very good results are obtained from cold water, camphorated brandy, solutions of chlorures, and compression especially, but that the efficacy of the latter varies according to its application. Thus, I am persuaded that the straps are preferable to simple compression, because their employment is easier; because they do not fall off, and may remain a much longer time; that in those of the second degree, cold water, refrigerants, chlorurated solutions, especially, may cure, the phlyctænæ being first removed; for I hold much with this little operation, without which I never employ any application." (p. 186.)

His mode of proceeding is thus described:—"1. Strips of cloth spread with diachylon are to be applied upon the injured surface. 2. Indispensable that they should be applied very equally on every part of the wound to prevent strangulation. 3. They must be so applied as not to loosen, and it is therefore necessary they should make at least one turn and a half round the leg. 4. When the regions upon which they are applied are irregular, the hollows must be filled with charpie or cotton; thus, for instance, if there be a wound on the foot, the sole is to be thus padded, so as to form a rouleau. 5. The strips require different directions according to the form of the limb on which they are applied; thus, on the leg, which forms a cone, they must be placed spirally, commencing from below upwards. 6. Each strap should cover two-thirds of the width of that below it, to render the compression uniform." (p. 187.) The advantages derived from this plan of treatment are, according to VELPEAU's views, the following:—

"1. In burns of the first and second degree, the application is followed by a more prompt cure, *i. e.*, it is completed after one or two applications at most, or in a day or two. 2. That in those of the third degree three or four applications are needed, which require eight days at most, whilst other modes require fifteen days or a month. 3. That the cure of burns of the fourth degree depend on the depth of the wounds." (p. 186.)

In now proceeding to give an account of my own mode of treatment, I would premise that HENRY EARLE's observations on the careless mode in which clothing is too commonly removed after burns and scalds, are well worthy attention. "It unfortunately happens, too frequently," says he, "under these circumstances, that the first thing done is to remove the stocking, which often brings away with it large portions of the cuticle, leaving the inflamed cutis denuded; for, although in these cases sufficient time may not have elapsed for the occurrence of inflammation and the production of vesications, yet the application of the hot liquid will cause sufficient separation between the dermis and epidermis to cause it to come away on pulling off the stocking. If, instead of this forcible removal of the clothes, such limbs were to be immediately immersed in the coldest water, this most serious result would generally be prevented. The same clothes which were the medium for retaining the heat may be made the readiest means of abstracting it and of diminishing the inflammation; and, should it become necessary, in consequence of the formation of vesicles, to remove them, they should be cut away with the utmost caution, and the vesicles preserved unbroken; by which the serious consequences which follow the exposure of the highly inflamed cutis, will be prevented." (p. 301.)

The justness of these observations, as regards not merely the increase of the patient's sufferings, but also as to rendering his situation much more dangerous, especially if the vesications be large, must be sufficiently obvious. It is, therefore, scarcely necessary to

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(*a*) His Clinique—Brûlures, Traitement par les Bandelettes de Diachylon; in Lancette Française, vol. ix. 1835.

observe that the removal of the clothes should be effected with great carefulness, and **Earle's** advice as to thoroughly soaking them in water, either warm or cold, according as the practitioner may prefer applying his remedies in one or other state, is very excellent and highly deserving of being acted on. After soaking, it is better to cut the clothes through with scissors, till the whole will drop off or the patient can be lifted out of them, rather than to drag him about as is frequently done for the purpose of saving the clothes at the expense of the patient's skin.

My own observation and experience lead me to consider the local treatment of scalds and burns as very simple, the great object in view, if there be vesication, to whatever extent, without death of the skin or subjacent parts, being to defend the exposed highly sensible surface of the true skin from the air, by affording it an artificial sheathing, and thus relieving the irritation of the nervous system. If the vesications be unbroken, I think it best to leave them undisturbed, as adhesive matter is speedily effused over the surface of the true skin, directly after the effusion of serum has ceased; an observation which may be daily made in watching the progress of an artificial blister. After a time, about forty-eight hours, the serum within the vesication becomes irritant, and this circumstance is indicated by the margin of the uninjured skin bounding it presenting a red line. The skin must then be punctured in several parts, varying according to the size of the blister, and near its base, so that the serum may escape, which it generally does slowly, the serum now holding in solution a large quantity of albumen, and not unfrequently seeming as it were contained in large cells, resembling those containing the vitreous humour of the eye, although much larger. If when the patient be first seen the blisters are found already burst, the cuticle should not, on any account be removed; for, wherever it covers it forms too good a sheathing to be taken away. In either of these cases I generally first apply linen soaked in warm lime water and linseed oil, keeping it continually wetted with a sponge, without removal for forty-eight hours, after which, suppuration having by that time usually commenced on those parts of the wound which require it for their cure, I have the lime water and oiled cloths gently removed, and all the injured parts, whether to little or great extent, enveloped in bread and milk poultices, which are renewed twice or thrice a day, according to the discharge. This application is very bland, a delicate film from the coagulable part of the milk, and the mucilaginous portion of the bread soon covers the exposed tender surface, or keeps the remaining cuticle supple and moist, thereby rendering the patient extremely comfortable, at the same time, also, that he is kept very clean, and free from offensive smell, which are points of extreme importance in the treatment of scalds and burns, as regards both the health and comfort of the patient. I rarely find it necessary to employ any other treatment; for, if the accident be not extensive, in a few days it heals, and, if it be more spread, though the time of cure is necessarily longer, yet, the same result ensues. Sometimes, however, more to relieve the patient from the strict rest which the poultice requires than for any other cause, after five or six days, the poultice is left off, and zinc ointment spread on lint or soft linen is applied.

If the true skin, or together with it more or less of the subjacent parts be destroyed, I still consider a poultice the best, most cleanly, and most comfortable application, made either simply of bread and milk, or bread and linseed meal, which are to be continued till all the sloughs have separated and granulations have been fully produced. After which wax and oil, or zinc ointment, or calamine ointment, spread on lint, may be gently bound on with a roller.

If the granulating surface be very extensive, it is generally long in cicatrizing; the granulations become pale and flaccid, or even disappear, and the pus thins and becomes limpid on the slightest disturbance of the digestive organs, thus putting a temporary stop to the cure; but, the irritation removed, things revert to their former channel, and healing is resumed. These alternations occur frequently in the course of a long cure, and must always be carefully watched and tended, as often the suspension of suppuration for a few hours causes determination to other parts, as the brain, lungs, and mucous membrane of the bowels, and the patient is cut off at the very time when there is every reason for his recovery.

From the observation I have made of the various modes of treating scalds and burns, it appears to me that it is matter of little consequence what the primary application is, provided it be warm or capable of preserving the warmth of the part. Cold washes I do not approve of, especially if the injured surface be large, as then a considerable portion of the body or limbs is suddenly cooled, and very frequently severe shivering is excited which adds much to the patient's discomfort; or if, as is often the case, the patient be already shivering, that condition is increased by the application of cold.

If stimulants be at first applied according to **Kentish's** plan, or, if cold washes be used immediately after the accident, the important point is to determine how long they shall be continued. This, in reference to stimulants, has, as already mentioned, been determined by KENTISH; and, with regard to the cold, is generally continued either till suppuration or sloughing is decidedly set up, and then, as the case may be, simple dressings, either with ointments, or absorbing powders, or poulticing, are resorted to. But I think my plan of poulticing throughout is preferable.

With regard to the vesications in burns and scalds, unless they be very extensive and attended with destruction of the underlying parts, it will have been observed from what I have already stated that I do not consider them of very material consequence if properly attended to. But many persons think it important to prevent them, and endeavour so to do by their treatment, whatever it may be. HIGGINBOTHAM (*a*) of Nottingham speaks in favour of using nitrate of silver for this purpose, and says:—"I have found that by slightly passing the nitrate of silver once over a burnt surface, the pain is increased for a short time, but then totally subsides, vesication appearing to be prevented; the black cuticle peals off in a few days, leaving the part well." And further:—"In cases in which the cuticle has been removed, the nitrate of silver applied on the surface induces an adherent eschar, and prevents the consequent ulceration." (p. 149).

The complete charring of the skin of a limb is no proof that the subjacent parts are destroyed or that they will slough and the case terminate, if there be sufficient strength of constitution by spontaneous amputation. The removal of the limb under such circumstances, immediately, is not advisable. But if it be fully ascertained that the entire mass has perished, immediate amputation is inadmissible; for the limb is under precisely the same conditions as if under gangrene from any other cause, or gangrenous spontaneously. There is always inflammation in the neighbourhood, either resulting at once from the extended influence of the destructive agent, or very shortly after set up to bring about the separation of the dead from the living part; and if, whilst either of these exist, amputation be performed, there is every probability of a sloughy stump and increase of danger to the patient. It is, therefore, necessary to wait till a line of demarcation between the living and dead parts be formed, simultaneously with which, if the progress of the case be favourable, the inflammation begins to subside, and ceases as suppuration is established, and then is the time to perform amputation if needful. Cases of this kind are not frequent (*b*).

Sometimes it happens that the destruction of skin on a limb has been so great that large wounds remain for weeks or months without any disposition to heal, and with great draught on the patient's powers, from the large suppuration which is kept up. If the use of absorbent powders, as calamine or chalk or the application of nitrate of silver in lotion upon soft rag or lint be insufficient to check the discharge, and to induce the formation of skin, then, if the patient's constitution begin to droop, and not till then, I think, should amputation be performed.—J. F. S.]

100. In burns with gunpowder, which, from the black crust covering the part, often seem much more dangerous than they really are, the grains of powder often penetrate the skin, and, if they remain after the cure, grow in and produce a bluish-black discoloration. In parts commonly uncovered, as the face, they must either at first or during the suppuration be removed with a lancet or with a needle; in other respects, the burn is to be treated according to the ordinary rules. If the grains of powder heal in, each must be removed by a little cut.

101. The employment of internal remedies in burns must be guided by the constitution of the patient and by the severity of the symptoms. If the inflammation be high, powerful antiphlogistic remedies must be employed; thereby only can the spread of the inflammation and gangrene be prevented. The great pain and nervous symptoms so commonly accompanying severe burns require at the same time opium both internally and externally in connexion with the ointments mentioned, cherry-laurel water, extract of hyoscyamus. If there be a bad state of the juices, or great weakness, these must be specially attended to in the treatment.

(*a*) An Essay on the Use of Nitrate of Silver in the Cure of Inflammation, Wounds and Ulcers. London, 1829. 8vo. 2nd Edition.

(*b*) Two cases of mortification resulting from burn, in which amputation was performed, are mentioned in the Lancet for 1840, 41, vol. ii. p. 687.

[The internal treatment of scalds and burns is too often overlooked, or little thought of, till it be too late, though it is a very important item in the restorative proceeding. If, soon after the accident, as commonly happens, the patient be attacked with shivering, which is severe in proportion to the extent of the part injured, some stimulant must be given internally, and I think a little hot brandy and water, even to children, is preferable to physic. It must be of course given with discretion: for a young child a teaspoonful of brandy mixed with seven or eight of hot water, and then a teaspoonful or two of the mixture given every quarter of an hour till the shivering subsides; for an adult half a glass or a glass of brandy to two of hot water may be given immediately, and repeated twice or thrice at intervals of a quarter of an hour, as may be needed. The patient should be quickly put to bed, covered with blankets, and warm bottles or hot bricks wrapped in flannel applied to the feet, for the purpose of re-exciting warmth.

It is matter of dispute among surgeons, as to the propriety of admistering opiates or other sedatives, an objection being made that the action of the opium interferes with the symptoms, so that it is impossible to determine whether the brain be affected by the irritation of the injury or by the action of the opium. I do not think this is matter of much consequence; but I am quite certain that soothing the patient's sufferings and dulling his nervous irritability, are most important indications in the constitutional treatment. Therefore I invariably prescribe laudanum for an adult or syrup of poppies for a child, if there be any disposition to restlessness; and, if it continue, the opiate is repeated a few hours after. The advantage derived from sleep, even for a short period, is very great, and cannot be too strongly recommended, as during that time the stinging of the burn diminishes, and the patient suffers less. If sleep at night be deficient or much disturbed, I think it better to give laudanum in sufficient quantity to procure it; in less quantity it irritates, and is hurtful, and this may be continued for some time, as may be found necessary.

In severe burns and scalds sickness and vomiting very frequently occur after the accident, and require to be checked by brandy and laudanum; but when they continue it is to be considered a very unfavourable symptom.

Till suppuration is set up, which usually is established in forty or fifty hours, the patient suffers more or less from febrile excitement; cooling drinks and saline medicine in a state of effervescence may then be given, and light farinaceous food if the patient be disposed to take it, which, however, is generally not the case. But immediately suppuration, or the separation of sloughs commences, the constitution must be supported proportionally to their degree; easily digestible animal food is then to be taken, and beer, porter, wine, or brandy, in proportion to the patient's age, habits, the degree of suppuration and extent of the slough must be used. Care, however, must be taken that the patient be not overloaded with support, which is indicated by quickened pulse, heat of skin, restlessness, and flushing of the countenance. When such occurs, this treatment must be suspended, and it not unfrequently happens that under this excitement the suppuration is suspended, and effusion of water on the brain, indicated by drowsiness and stupor or irritation of the mucous membrane of the bowels, and watery purging set in, which are very dangerous, and frequently destroy the patient. If sufficient support be not given, typhoid symptoms come on, and the patient rapidly sinks from that cause.—J. F. S.]

102. In all burns in which there is suppuration, care must be taken, especially during cicatrization, that no unsightly scar be produced; the parts must be kept in their natural place, and the contact of neighbouring parts, as the fingers and toes, be prevented by layers of linen or charpie smeared with salve.

[A most important circumstance in reference to burns and scalds is the character of the scar, in those cases where the skin has been extensively destroyed, in consequence of not merely the uncontrollable disposition of the granulations to contract during the progress of cicatrization, but also of the contractile habit of the scar itself, long after the wound has healed, when it is presumed that no further attention to the case is requisite. And even though every precaution has been taken to guard against the effects of this contractility, yet very often do the most deplorable results ensue, not only as regards personal appearance, but also in relation to diminution and restriction of the motion of the limbs. "These contractions are," as Henry Earle (a) observes, "a source of blame to surgeons;" but I cannot agree with him that even "in some instances, perhaps, such reproaches are merited, as much may be done to prevent them by proper and strict attention to position during the progress of the healing process;" and, indeed, his own subsequent observation is a complete and satisfactory refutation of this statement; for, he continues, "frequently, however, such contractions do not depend on any inattention on the part of the surgeon, but are the result of a natural process which follows cicatrization, and which has often baffled all the efforts of art to control. This process consists in an absorption of the granulations on which the new skin has been formed." (p. 97.) The surgeon, therefore, is not blameable for the results of this natural process, which not merely follows cicatrization, but actually proceeds with it *pari passu*, or even commences before the formation of new skin; for the granulations, as HUNTER observes, "being endowed with such properties, they soon begin to contract, which is a sign that cicatrization is to follow. The contraction takes place in every point, but principally from edge to edge, which brings the circumference of the sore towards the centre; so that the sore becomes smaller and smaller, although there is little or no new skin formed. (p. 483.) Besides the contractile power of these granulations," he continues, "there is also a similar power in the surrounding edge of the cicatrizing skin, which assists the contraction of the granulations, and is generally more considerable than that of the granulations themselves, drawing the mouth of the wound together like a purse. * * * This contractile power of the skin is confined, principally, to the very edge, where it is cicatrizing, and, I believe, is in those very granulations which have already cicatrized; for the natural, or original, skin surrounding this edge does not contract, or at least not nearly so much, as appears by its being thrown into folds and plaits, while the new skin is smooth and shining. (p. 484.) Whether this contraction of the granulations be owing to an approximation of all the parts by their muscular contraction, like that of a worm, while they lose in substance as they contract, or, if they lose without any muscular contraction, by the particles being absorbed, so as to form interstices, (which I have called interstitial absorption,) and the sides afterwards fall together, is not exactly determined, and perhaps both take place. * * * After the whole is skinned, we find that the substance, which is the remains of the granulations on which the new skin is formed, still continues to contract, till hardly anything more is left than what the new skin stands upon. This is a very small part, in comparison with the first formed granulations, and it in time loses most of its apparent vessels, becomes white and ligamentous." (p. 485.)

(a) On Contractions after Burns or extensive Ulcerations; in Med. Chir. Trans., vol. v.

From this constant tendency of scars to contract, even from the very beginning of their production, they almost invariably, when the wound extends over the bending surface of a joint, as, for instance, the front of the elbow, wrist, or ankle, produce gradual and permanent flexion to a greater or less degree, and, by the unconscious efforts of the patient to overcome this restriction, and the unyieldingness of the scar itself, the scar is lifted up from the surface on which it was originally formed, the elasticity of the surrounding skin being (if the expression may be permitted) presumed upon, so that it yields to the forward movement of the scar till, becoming tense, it can yield no further, whilst the scar assumes a thick web-like character, doubling on itself as it rises, and stretching from the upper to the lower member of the limb, its edge being rounded and usually thicker than the rest of its extent, so that it has an appearance very similar to the skinny expansion between the upper and fore arm of birds upon which the covert feathers are arranged.

If the burn or scald have been on the chest it is not uncommon to find the skin on the front of the arm-pits dragged inwards by the transverse contraction of the scar, and the arms pinned to the sides. The skin of the neck, also, is drawn down, so as to cause more or less deformity, and instances are not wanting where, if the burn or scald have extended on the front of the neck, the skin of the face has been pulled down, the lower lip more or less completely everted, and the lower jaw constantly depressed, except when the head is bowed forwards, which it is even sometimes permanently. Indeed, I can fully admit the truth of H. EARLE's statement:—"I have known this gradual contraction draw down the chin upon the sternum, and approximate the shoulders so much as to cause a partial absorption of the clavicles, and completely alter the dimensions of the thorax." (p. 98.)

From what has been stated it is clear that, after destruction of the skin by severe burns and scalds, the contraction of the scar, as a natural consequence, may be expected, however careful the surgeon may have been in his endeavour to prevent it, and therefore he is not blameable.

But it becomes a question, whether any thing can be done to set free the limb restricted in its motions, and sometimes rendered useless by the contracting scar. Formerly the scar web has been cut through to the bend of the joint, which at the time permitted increased extension of the bent limb; but, as the wound healed, the contraction was reproduced. I believe the whole of the webbed portion of the scar has also been removed, leaving, however, the small part which lay flat on the limb, but, when cicatrization had taken place, the contraction again appeared. HENRY EARLE, therefore, "proposed to remove the whole cicatrix, and to endeavour to approximate the integuments from the two sides of the arm, which was to be kept extended on a splint, not only during the healing of the wound, but for a considerable time after the cicatrix had formed, until, indeed, those changes which I have above described had been fully accomplished. By such practice I conceived that the contraction, which I knew must follow so extensive a wound, would take place in a lateral direction, and not in the long axis of the limb." (p. 100.) On this principle **Earle** operated on a boy of six years old, whose fore arm was contracted to a right angle by the contracting web-like scar of a burn which he had suffered twelve months before. He did not remove the scar entirely, but left it connected with the skin above, hoping it would adhere to the bared parts as far as it would cover, and so lessen the extent of skin required; but, in four days, it was found to have sloughed, not being sufficiently vascular to preserve its vitality. Directly after the scar had been detached at the operation, attempts were made to extend the arm; but "considerable resistance was met with from the forcible contraction of the flexor muscles, which had been so long accustomed to a more limited sphere of action, that they with difficulty admitted of any extension. By degrees, however, they yielded considerably, and the arm was brought nearly to a right line. When the arm was so extended, the extreme point of the cicatrix, which still remained attached to the upper arm, was deficient nearly three inches of reaching the part from whence it had been removed." The operation was performed on the 12th November, 1813, and on 20th December following the wound was healed. The splint was continued for six weeks longer; after which, the arm continuing straight, it was worn only at night for three months, and motion permitted, and, at the time of reporting the case, five months after the healing of the wound, **Earle** says:—"His arm continues perfectly straight, and he enjoys the free and perfect use of it as much as of the other." (p. 102.)

I have recently performed this operation with modification in a very severe contraction. Up to the present time (March, 1845) it has succeeded equal to my most sanguine expectations; but months must elapse before the actual result can be obtained. The description of my proceeding will appear in the following account of the

Case.—E. F., aged 21 years, a healthy country girl, had her clothes set on fire twelve years ago, in consequence of which her shoulders, chest, and arms were very severely burnt, and she was confined to her bed for nineteen weeks; but the wound did not fully heal for some time afterwards. At first there was no contraction; but, soon after, the scar began to contract, the skin over the front of the chest being first drawn towards the right shoulder, so as to form a fold across and below the front of the arm-pit; a similar process followed on the left side, and both sides of the back also soon took on the same disposition. An incision was made through the fold on the right arm-pit soon after the contraction had taken place, but without benefit, and she has since remained in her present condition.

A large scar now occupies the whole front of the chest, involving the breasts, which are not developed, and of which the very small nipples are scarcely perceptible among the coarse meshes which the intersecting transverse rays of the scar form, as they continue on either side, across and below the arm-pits to the middle of the upper arm, deepening the axillary fold by a thick skinny web, about an inch below the edge of each pectoral muscle, with a rounded thickened margin on which the cuticle is scaly, and the cutis cracky. The contracting scar draws the skin tightly on the upper and outer part of the limbs, in consequence of which the upper arms are almost closely tied to the sides of the chest. A large triangular web extends from the axillary web nearly to the radial side of the wrist of each fore arm, with a thick rounded edge confining the right arm at less than a right angle, and the left at about a right angle with the upper arm, beyond which neither can be extended.

Dec. 7, 1844. The following operation was performed on the right arm, which I had purposed performing according to **Earle**'s method, but with complete removal of the scar, and with making a second long incision through the sound skin at a distance from the scar wound, so as to diminish the dragging of the skin in bringing and pinning the edges of the scar wound together, on the same principle, that of relieving tension, with which **Dieffenbach** makes incisions in his plastic operations. It will be seen, however, that I proceeded very differently, and much further.

By an incision through the sound skin on each side of the scar web, commencing through the scar on the front of the arm-pit, and terminating below the point of the scar on the front of the wrist, I removed the whole of the scar skin which bound the fore to the upper arm, producing a long gaping wound, the skin edges of which could scarcely be approximated. I then made a second cut from the outer edge of the wound, at the front of the elbow, carrying it downwards and outwards nearly to the outside of the wrist, so that it had a lance-like shape, pointed above and wide below, and, by partially dividing its cellular connexions with the fascia of the fore arm, freed it so as, without difficulty, to bring its inner edge in contact with the corresponding edge of the scar wound. I hoped, also, by detaching the slip that the skin on the outside of the arm, which I also separated from its subjacent connexions, might be shifted upwards, might participate in forming the principal cicatrix on the upper arm, and by its wavy direction from the arm-pit to the outside of the wrist, might, when hereafter its contraction shall commence, render the drawing up of the fore to the upper arm less probable, as the scar, not being straight but wavy, would be of greater length, and, being unequally acted on, would ultimately become straight, though without shortening, so as to restrict the straightening of the fore arm.

Having proceeded thus far, I presumed I had done with the knife, and then attempted to extend the fore arm; but, having used as much violence as I thought advisable, although it was not much, I found not the least yielding, but the fascia around the front of the elbow-joint being rendered very tense and raised, I thought this might be the obstacle, and therefore, having divided it carefully upon a director thrust beneath it, I repeated the attempt at extension, with no better success.

By the division of the fascia the muscles passing over the front of the elbow-joint were exposed, and when the hand was pulled on the *m. supinator radii longus* becoming extremely tense, and seeming to be the principal resistant, I passed a director between its belly and that of the *m. flexor carpi radialis longior*, and cut the former across. Nothing was gained by this, and I then, with the concurrence of my friend and colleague Green, passed a director under the tendon of the *m. biceps flexor cubiti*, and divided it as it crossed the front of the joint. Attempts, though not violent, at extension were then repeated; but, being unsuccessful to any material extent greater than a right angle, we determined to rely on passive extension, but not to be commenced at once.

In the course of the operation the internal and external cutaneous nerves were divided as they crossed the front of the elbow and each gave a smart shock to the patient. I may observe also that I very nearly divided the brachial artery by accident, as, after the division of the tendon of the biceps, it started up, and the slight yielding which the fore arm had allowed, putting it on the stretch, had stopped its pulsation, so that it escaped me, although I had sought for it and for the median nerve, for the purpose of avoiding them, and I mistook it for a band of fascia and cellular tissue till, the pull on the fore arm being discontinued, its pulsation returned and discovered its character.

The edges of the inner wound were now brought together and connected with seven twisted sutures, beginning from the wrist and pinning upwards; but there was considerable stress on the skin, so that I feared the pins would ulcerate through, and that adhesion would not take place, as the interspaces would not completely meet; but they together with the outer wound on the fore arm were supported with some adhesive circular straps.

The patient was then sent to bed, a wet cloth applied over the whole arm; and a circular bandage carried round her chest having been fastened to the head of the bedstead, to prevent her trunk slipping down, a bandage was wound round the wrist, and, its ends being carried down over the foot-board of the bed, a four-pound weight was attached, which pulled the hand so as to promote extension of the fore arm, by tiring the flexing muscles, without giving the patient much pain. ℞ *tinct. opii* ℨss. *ex mist. camph. stat.*

Dec. 8. She had passed a tolerable night, and when seen this morning was free from pain, the weight not pulling heavily, and she is without fever. Towards night she was very restless, and the arm becoming very painful and uneasy from the pull upon it, the weight was removed. ℞ *morph. mur.* gr.ss. *stat.*, which was given at 2 A.M.

Dec. 9. After taking the sedative she had a good night, but is feverish this morning; her pulse quick and skin hot. The weight was reapplied, and the uneasiness seeming to have depended principally on the slipping to the arm-pit of the bandage confining the trunk, it was readjusted.

Dec. 10. She could not go to sleep till the weight was removed, but afterwards passed a good night without taking any sedative, and is tolerably well. The dressings and pins were removed, each strap of plaster being replaced by another before a second was removed. No union at any part of the edges of the wounds, which are angry; most of the pins had nearly ulcerated through, and the remaining bits of skin by which they held are sloughy. The weight was reapplied, but is to be removed as often as the pulling becomes painful. There does not appear any material increase of extension. She is to have a couple of eggs daily.

Dec. 13. Has continued going on well; but, last evening, being restless, she took *morph. mur.* as before, and had a tolerable night. Her bowels have been relieved this morning with castor oil; she is altogether comfortable and has a good appetite. The arm was dressed to-day with adhesive plaster; the sloughy edges are cleaning and the discharge is healthy, but the skin about the elbow is very loose. The fore arm is certainly more extended, though not considerably. Is to be dressed daily, and the extension kept up with the weight as she can bear it. To have a mutton chop to-morrow.

Dec. 20. Has been improving since the last report; the wounds are granulating kindly and the edges of the skin becoming adherent. The fore arm has been gradually coming down, and now forms, with the upper, an angle of 135°.

Dec. 24. The extension of the arm still continues increasing. The wounds are healing, but in front of the elbow and above it there is still a pretty large patch of granulations. She seemed so well that I thought she might get up, and directed that the extension should be persisted in, by tying a four-ounce weight to her hand, and leaving it to hang unsupported by her side for ten minutes or a quarter of an hour frequently during the day as she could bear it without much distress. This weight, however, was rather more than she could manage, and a medicine-spoon, about half the weight, was used instead, and was found quite sufficient to tire the muscles and keep up the extension. Is to have a pint of porter daily.

Jan. 24, 1845. Has been going on well, and is capable of carrying the spoon for a greater length of time without annoyance; the wounds much diminished and still granulating kindly. She was yesterday attacked with slight head-ache, and is to-day feverish and has a quick pulse. ℞ *pulv. rhei c. hydr.* ℈j. *stat.*

Jan. 25. Tolerably well again, and the wound not disturbed.

Feb. 26. Still going on well; the wound healing slowly; the arm still straightening, and, as she has not yet made any attempt at bending, it is pretty stiff. I therefore desired that she should begin to do so, and also that she should carry occasionally heavier weights, which, indeed, she is disposed of her own accord to do.

March 7. Is beginning to bend the elbow a little, and since the last report carries with the right hand a two-gallon can of beer up a flight of stairs with little trouble. Is to exercise her arm by pulling a weight over a pulley fixed above her.

March 11. The long wounds upon the fore arm are all but healed. Upon the inside of the upper arm from the elbow upwards is a granulating wound, about two inches long and an inch and a half wide, which is granulating kindly; but its healing seems retarded by the pull of the broad scar which deepens the back edge of the arm-pit. This I propose soon to set at liberty, by cutting vertically through its connexion with the trunk, and inserting a piece of skin from the back.

In mentioning this case it must not be supposed I consider its success decisive; whether it be so or not requires many months to prove, and depends, I believe, considerably on the favourable result of the proposed plastic operation. It has, however, gone on so very satisfactorily, that I have ventured to relate it here, and I hope in a future part of this work to mention the result.—J. F. S.

Professor Mütter (*a*), a very intelligent surgeon of Philadelphia, has proposed the performance of plastic operations for the relief of deformities from burns, and has thus operated successfully in six out of seven cases, the first three of which he has published. All these were cases of forward contraction of the neck, with depression of the lower jaw, and eversion of the lip. His operation consisted in cutting across the middle of the scar, commencing in the sound skin on one and terminating in the sound skin on the other side of the neck, so that it was "about three quarters of an inch above the top of the sternum," * * * his object in making it so low down being "to get at the attachments of the sterno-cleido-mastoid muscles," both of which it was necessary to divide in the first, and one only in the second case, before the head could be raised to its natural position; but the head could be raised without dividing either, in the third case. A large gap was thus formed, into which was inserted a corresponding flap of skin, raised from the side of the neck, and from the deltoid muscle, without detaching it above, and fixed by several twisted sutures and adhesive straps. The edges of two-thirds of the wound on the shoulder were approximated with twisted sutures, and over the remainder, which could not be covered by the skin, a warm water pledget applied. The head was kept back by a bandage, and the patient then put to bed. She was not permitted to take "any kind of nourishment, in order that adhesion or union by the first intention might be accomplished," till the third day after the operation, and then only a few spoonfuls of barley water every hour or two. On the third day after the operation the

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(*a*) Cases of Deformity from Burns successfully treated by Plastic Operations, Philadelphia, 1843. 8vo. Also, in American Journal of Medical Sciences, July, 1842.

dressings were removed, "the wound found united, with the exception of here and there a point and a small pouch of pus at the most depending part of the flap," which was punctured and the pus evacuated. Some of the pins were removed, and fresh straps applied. This the first case succeeded admirably, and the history of the other two which he has published, were nearly counterparts of it. After the incision had healed, the head was supported by "a stiff stock on which her chin rested, and this instrument also served to press the integument back, by which the natural excavation or depth of the neck, in front was readily effected."

With the view of determining the propriety of the operations, such as those reported by him, MÜTTER makes some very interesting and valuable observations on, "1st, the nature of the tissue to be divided or removed; 2ndly, the thickness or profundity of the cicatrix; 3rdly, its location; 4thly, its extent; 5thly, its age; and, 6thly, its peculiar deformity."]

When large burns scar, there not unfrequently arises abdominal disorder, and frequent watery evacuations, which must not be suppressed.

III.—OF FROSTBITE.

Anweisung, alle erfrornen Glieder aus dem Grunde zu heilen, auch dann noch, wenn sie seit mehreren Jahren erfroren sind. 2nd Edit. Pirna, 1804. 8vo.

OTTENSEE, J. C., über die gründliche Heilung der Frostbeuten, in VON SIEBOLD'S Chiron., vol. ii. p. 129.

THOMSON, JOHN, M.D., Article—*Frostbite;* in his Lectures on Inflammation, p. 613.

DESMOULINS, De la Gangrène par Congélation. Paris, 1815.

MORNAY, Sur la Gangrène des Extrémités par Congélation. Strasbourg, 1816.

LARREY, Mémoire sur la Gangrène sèche causée par le Froid, ou Gangrène de Congélation, in Mém. de Chirurgie Milit., vol. iii. p. 60.

103. In *Frost-bite*, (*Congelatio*, Lat.; *Erfrierungen*, Germ.; *Congélation*, Fr.,) the severe and continued cold produces numbness of organic parts, so that sensation and motion are diminished, and, if its influence be continued, all sensation and motion are lost, the pulsation of the arteries ceases, and death ensues, in consequence of which the part is shrivelled and dried (1). If the whole body be subjected to such influence, the skin becomes gradually pallid and insensible; from the collection of blood in the internal parts especially in the brain and lungs, arise anxiety, weakness, disposition to sleep, and, if these symptoms occur and the cold continue, death is the result (2). This particularly happens after the use of spirituous drinks without sufficiently active exercise.

[(1) The parallelism of the effects of great degrees of heat and cold upon the animal body is very remarkable; for, though the causes are so opposite and unlike, yet are their results precisely similar, in almost whatever degree they are applied. Thus heat and cold produce only agreeable sensations when not advanced beyond a certain degree; but, if exceeding that, then both become painful without, however, exciting inflammation. A further degree of heat causes vesication, without death of the part, by merely exciting at first sufficient inflammation, or at least sufficiently increased action, to produce immediately the effusion of serum necessary to the formation of a blister. An increased degree of cold acts differently, inasmuch as its primary effect is to suspend the passage of the blood through the vessels, whence arise the blueness and puffiness of the cooled part, which is still painful, and has its motions restricted. But, if the cold be continued, the part becomes pallid, or yellowish-white, as if the blood were squeezed out of it, and its vessels emptied; the pain now ceases, the part becomes numb and motionless, but it does not vesicate. When the coldness subsides, the heat not only returns, but exceeds the natural standard; the pain also recurs and becomes more severe; inflammation being thus set up, its termination depends on the mode of treatment followed out. A still greater degree of heat or cold produces mortification, which, when depending on heat, except in the very rare cases where the part is actually incinerated, is most commonly, and at once, superficial, even in burns which are always more severe than scalds. But mortification from severe cold is almost invariably of the whole mass affected, rarely seems to be produced immediately, at least not in this country, but requires the lapse of several hours for even its appearance, and many more before the whole extent of the injured part declares itself dead, the mortification, if of the extremity, commencing with the tips of the fingers and toes, and gradually creeping up so far as the vital powers have been either totally extinguished, or have been so disturbed as to be unable to resolve the inflammation, depending on either the congestion of the vessels, or their acquired imperviousness, into the natural condition of the part.—J. F. S.

Müller (*a*), in drawing a comparison of the effects of heat and cold on the body, observes:—"Both can produce as well a disturbance of the excitability as irritation, inflammation, and mortification. A sudden violent operation of cold upon warm animal parts acts destructively. An extremely cold state is painful, and then numb. In still greater degrees, mortification, local death ensues. In less degree cold, destroying by abstracting heat, produces symptoms of inflammation and irritation in the efforts made by the parts for restoration of their equilibrium. In a moderate degree cold operates momentarily as an excitant; thus, cold water at once reddens the skin, as I have myself experienced in bathing in the river in October; but this was only momentarily, and slight signs of internal disturbance from the abstraction of heat ensued. Cold water, also, in fevers, with a very hot, dry skin, acts often mediately as an enlivening stimulant, and produces that turgor on the skin which warmth excites in cold parts. The secondary effect of continued cold is always a disturbance of the nervous system. The gradual operation of cold up to a high degree throws man into a condition of seeming death, and hybernating animals into their winter sleep by withdrawing their irritability; whilst a great degree of warmth gradually, also, disturbs the functions of the nervous system, but probably by a change; and in sandy deserts, where there is at the same time want of water, produces asphyxia, and causes the summer sleep of amphibians, and of the tenrec in hot climates." (vol. i. p. 86.)

The length of time, during which a part remains cooled, has material influence in regard to its immediate mortification, its deferred mortification resulting from the degree of inflammation excited by the cold, or simply to its inflammation which resolves without mortification. This is proved by **Hunter's** experiments in freezing rabbits' ears (*b*). In one case "the ear remained in the mixture (of salt and ice) nearly an hour, in which time the part projecting into the vessel became stiff; when taken out, and cut into, it did not bleed; and a part being cut off by a pair of scissors, flew from between the blades like a hard chip. It soon after thawed, and began to bleed, and became very flaccid, so as to double up on itself, having lost its natural elasticity. When it had been out of the mixture nearly an hour it became warm, and this warmth increased to a considerable degree; it also began to thicken in consequence of inflammation, whilst the other ear continued of its usual temperature. On the day following, the frozen ear was still warm, and it retained its heat and thickness for many days after." (p. 123.)

I have already mentioned the case of sloughing of the scrotum following the continued use, for a few hours, of ice to further the reduction of a rupture. We have in St. Thomas's Museum, also, the cast of a soldier whose scrotum having been frost-bitten in Flanders, during the campaign in 1793, under the Duke of **York**, both testicles, and a portion of the spermatic cord, were exposed, and long remained without skin, though completely covered with granulations.

Actual frost is not absolutely necessary to produce mortification; cold wet is quite sufficient if continued sufficiently long to reduce the natural heat of the part below a certain standard, and there retain it, as will be presently seen in a case of mortification of the hand from laying out hides, and this more especially when evaporation is going on quickly.—J. F. S.

(2) The interesting account given by Sir **Joseph Banks** (*c*), of the sufferings of himself, of Dr. **Solander** especially, and other of their companions, from exposure to cold is well known, and is quoted by **Thompson**, (p. 619,) who also mentions (p. 620) another remarkable case of Dr. **Kellie's**, which had been previously reported (*d*).]

104. When a limb or active body becomes frozen, the living activity is depressed by the torpidity of the juices, a state of asphyxia is present,

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(*a*) Handbuch der Physiologie.

(*b*) Observations on certain parts of the Animal Œconomy. London, 1792. 4to. 2nd Edition.

(*c*) Captain Cook's Voyages, vol. ii. Hawkesworth's Edition.

(*d*) Duncan's Edinburgh Medical and Surgical Journal, vol. i. Edinburgh, 1805.

which is yet susceptible of reanimation, but which, if left to itself, must necessarily run into gangrene or death. Those parts are most commonly affected by the dangerous effects of cold which are most distant from the heart, and in which the evolution of warmth, under natural circumstances, is slight, as the hands, ears and nose; especially if the circulation through them be hindered by accidental pressure.

Hunter (*a*) observes that, in frost-bite, "the effect of the cold is that of lessening the living principle. The powers of action remain as perfect as ever, but weakened; and heat is the only thing wanting to put these powers into action; yet that heat must at first be gradually applied and proportioned to the quantity of the living principle, which increasing, the degree of heat may likewise be increased. If this method is not observed, and too great a degree of heat is at first applied, the person or part loses entirely the living principle, and mortification ensues." (p. 137.)

Astley Cooper (*b*) says:—"In this climate, destruction of the life of the part does not, in general, immediately succeed" the application of a great degree of cold for a considerable time to a part; but "the part will become numbed, that is, its nervous power will be diminished; and, when it is thus enfeebled, it will be unable to bear a very slight degree of inflammation, and the destruction of its life follows. * * * It generally happens that inflammation succeeds the application of cold after an interval of two or three days." (pp. 215–16.)

Larrey (*c*) does not consider, in frost-bite, "the cold as the determining * * * but merely the predisposing cause" of mortification; and observes, in support of this opinion, that, at the time of the battle of Eylau, the French soldiers "did not experience any painful sensation during the severe cold (varying from 10° to 15° below zero of Réaumur's thermometer) to which they had been exposed on the night-watches of the 5th, 6th, 7th, 8th, and 9th of February, 1813; and that it was not till the night of the 10th, when the temperature had risen from 18° to 20°, (a great quantity of sleet having fallen," as he mentions previously, "on the same morning, and been the forerunner of the thaw which took place in the course of that day, and continued in the same degree for several days,) that they felt the first effects of the cold;" and "applied for succour, complaining of acute pain in the feet, and of numbness, heaviness, and prickings in the extremities. The parts were scarcely swollen, and of an obscure-red colour. In some cases, a slight redness was perceptible about the roots of the toes, and on the back of the foot; in others, the toes were destitute of motion, sensibility, and warmth, being already black, and, as it were, dried." (pp. 60–2.) Larrey's objection to the cold being the determinate cause of the mortification, is not borne out by this account; for it is well known that the cold produced during a thaw is much more severe from the accompanying evaporation, than whilst freezing continues. It may be also observed, that a greater degree of dry cold than of wet cold can be borne without inconvenience or danger, as our daily experience proves in dry frosty and cold wet weather.—J. F. S.

The two following cases, for which I am indebted to my friends and colleagues Green and Solly, under whose care they were, present good examples, the first, of the usual result of frost-bite in this country, and the second, of mortification from continued application of cold moisture in an excitable constitution, arising from the use of beer and spirit:—

Case 1.—J. W., aged thirty-nine years, was admitted into St. Thomas's Hospital.

Dec. 15, 1829. He has followed various occupations, but has, in general, lived poorly; and has now mortification of both feet, of which he gives the following account:—

About a month since, being very destitute, he lay for four successive nights in the open air, at which time the weather was very cold. On the morning following the fourth night, he found himself, on rising, unable to stand from loss of sensation in his feet, and unconsciousness of touching the ground. He was removed by the police to Cold Bath Fields' Prison, where he states that, for some time, he was fed on gruel and on soup on alternate days. Soon after his arrival at the prison, the numbness of his feet was succeeded by a warm pricking stinging heat, and this soon followed by redness, swelling, and throbbing of the parts. He does not remember what treatment he was subjected to, but these symptoms, accompanied with great pain, continued for eight days; after which, in the course of a single night, both feet mortified, assuming an ashy-black colour, and here and there having small vesications. Simultaneously with this change, the pain remitted, and, in a day or two after, the line of separation between the dead and living parts appeared. He continued in the prison infirmary, the separation advancing, and his health varying but little, until his admission here.

(*a*) As just quoted. (*b*) Lectures on Surgery, vol. i. (*c*) As quoted above.

The entire soles of both feet, and the front of both as far as the tarso-metatarsal joints, were completely mortified. A line of healthy granulations divided the living from the dead parts in both feet nearly alike; in both, commencing from the metatarsal bone of the great toe, it crossed the bases of the other metatarsal bones to the outer edge of the foot, along which it stretched backwards beneath the outer ankle, around the heel inwards, and thence forward to the base of the great metatarsal bone. The sloughs were very offensive, and he complained of great pain and want of sleep. Pulse 90, feeble; appetite good; bowels confined; tongue moist and slightly furred. ℞ *ammon. carb.* gr.v. *conf. aromat.* ℈j. *tinct. opii.* ♏x. *mist. camph.* ℥jss. 6*tis.* He is to have meat, with half-a-pint of porter; sago, with a glass of port wine daily. The feet are to be wrapped in rags steeped in *lot. calc. chlor.*, and a poultice to be applied over.

Dec. 16. Has had a restless night; has a quick full pulse, head-ache, and a furred tongue, probably from repletion, he having been allowed to take meat, porter, sago, and wine at once, and his bowels being unmoved. The meat was, therefore, ordered to be discontinued; and a dose of *mist. senn. comp.* to be taken immediately, and repeated three hours after, if necessary.

Dec. 19. Has been relieved by the clearance of his bowels, and is better; but he complains still of want of rest. *Omitt. mist.* ℞j *opii.* gr.j. *t. d.*

Dec. 22. Still complains of great pain, but the separation is proceeding rapidly, and the dead parts seem held only by two or three of the metatarsal bones.

Dec. 26. To hasten the cure, it was thought advisable to remove the right foot, which having separated at the tarso-metatarsal joint of the great and little toes, the three middle metatarsal bones were sawn through about half-an-inch from their base, following the line of demarcation. The knife was carried along the sole of the foot, dividing two tendons, to the heel-bone, the tuberosity of which was divided by ulcerative absorption; and, with a few slight touches of the knife, the whole of the mortified parts were removed. A slight arterial bleeding occurred at the heel, but was soon arrested by pressure. A poultice applied. ℞ *ammon. carb.* gr.viij. *conf. aromat.* ʒss. *mist. camph.* ℥jss. 6*tis. op.* gr.j. *sexta quaque hora.*

Dec. 28. The left foot removed nearly as the right, but the three inner metatarsal bones, and the tuberosity of the heel-bone required sawing through.

Jan. 25, 1830. Continues improving in health; cicatrization goes on slowly. *Omitt. mist.* ℞ *opii.* gr.j. *quin. sulph.* gr.ij. *ext. gent. comp.* gr iij. *ter in die*, a pint of porter daily.

Feb. 8. Cicatrization in the left foot has proceeded rapidly, the stump having nearly skinned over; but, on the right foot it is tardy, and the exposed part of the heel is about to exfoliate.

Feb. 28. The exfoliated bone was removed.

April 3. The left stump is healed. The right has varied a little, according to the state of his health; but to-day three dark spots, corresponding to the points of the sawn-off metatarsal bones, have appeared. By the beginning of

October, A very indolent ulcer occupied the plantar surface of the remaining part of the foot; and, showing no disposition to heal, amputation is talked of. Superficial indolent ulceration of the extreme part of the left stump had taken place, but seems now disposed to improve.

Dec. 10. The right leg was amputated, by the circular incision, below the knee, and three ligatures applied.

Dec. 14. Stump first dressed; going on well.

Jan. 2, 1831. The wound nearly healed, but the ligatures have not come away. They separated, however, on

Jan. 4, One; on 10th, one; and on 13th, the last came off.

March 30. The ulceration on the left foot, which, at the time of the amputation, was only as large as sixpence, circular, and surrounded by a hardened edge, has recently spread over the whole sole, without any obvious local or constitutional cause.

June 1. The ulcer healing, but not reduced to its first size. Amputation was proposed, but declined.

Case 2.—T. B., aged thirty years, a tanner, was admitted

Feb. 3, 1845. He has been accustomed to live freely, and taken largely of beer, with the addition of spirits occasionally; but has enjoyed good health till within the last three months, in which he has head-ache, and been under the care of the out-patient physician, by whom he has been cupped on the neck and purged freely, but without benefit.

On the 24th of last month he was engaged, under cover, during a cold day laying out fresh hides till dinner-time, an occupation which kept his hands continually cold and wet. His dinner did not occupy him ten minutes; and his hands during that time having continued still cold, he returned to his work, and for five hours during the afternoon was engaged cutting off the horns from the hides, whilst he held the latter in his left hand. Towards the latter part of the afternoon he felt cold all over, and, when he had returned home, feeling his left hand very cold, and being unable to straighten his fingers, which had stiffened as he held the skins; but neither the fingers nor hand were yet discoloured. He put his hand into lukewarm water; but could not bear it immersed on account of the great pain excited, which was also brought on by holding the hand to the fire. Indeed, he was only easy when the hand was cold, and could not even bear it beneath the bed-clothes, but was obliged to keep it out upon the counterpane. Before putting his hand and arm into warm water, there was not any apparent change in colour; but, after the first and every succeeding dipping into warm water, the hand became red and redder, and more painful.

On the 25*th ult.*, when he awoke in the morning he noticed the nails were blackening about their roots; but he was free from pain, though the hand was very cold and numb, and was not prevented going about a little job.

On the 26*th* he again tried immersion in warm water; but the pain recurred, and the terminal joints of all the fingers and thumb had now become black. The mortification continued spreading; repeated applications of warmth always excited pain, and he was more easy in proportion to the part being kept cold.

On the 30*th* the mortification, having continued along the fingers, just entered the palm, and he began to suffer constant pain.

On *Feb.* 2, the hand had mortified up to the wrist; the pain was so gnawing and severe that he could not rest, and was accompanied with severe head-ache. He applied to a medical man, who bled him twice in the same day from the ailing arm, but did not get more than a pint of blood, and ordered warm applications.

Feb. 3. During the last night the gangrene had extended about one-third of the forearm upwards; has a dark colour, which terminates abruptly; is perfectly cold and insensible. He complains of pain in the head, aching and weariness of the limb, loss of rest at nights, general weakness, and failing appetite; he suffers much from thirst; his tongue covered with white fur, and the bowels confined; pulse 120, regular and weak, but perceptible at both wrists. A dose of infusion of senna with sulphate of magnesia was ordered forthwith; meat, and a pint of porter daily; warm fomentations and linseed-meal poultice to be applied to the hand.

Feb. 4. Altogether more comfortable. The bowels have been freely relieved; his tongue is cleaner, and the head-ache lessened. Is to have four ounces of brandy and two pints of porter daily.

Feb. 5. Is much the same; but feels very weak, though his appetite is improving. No pulsation can to-day be felt in the wrist of the ailing arm. The heart was carefully examined to-day, and its action and sounds ascertained to be natural. Is to have a mutton chop and two eggs, with three pints of porter, daily. ℞ *tinct. opii* ♏xx. *sp. ammon. comp.* ʒj. *ex mist. camph. 6tis.*

Feb 15. The gangrene has not spread since the last report; the line of demarcation between the living and dead parts is now apparent, and some vesication has occurred round the arm. The ulcerative process has continued steadily, and has now,

March 8, completely passed through the soft parts down to the bones, forming a regular well-shaped stump, the whole of which is granulating kindly. The gangrenous part has much the appearance of brown paper, and, though a little shrivelled, keeps its form, but is very offensive. It was therefore thought advisable to saw through the dead bones and remove it, which was done accordingly. His health has been steadily improving; he has scarcely had an untoward symptom, his head only aching occasionally; he sleeps well, and enjoys his food.

March 31. Wound cicatrizing, and there seems every prospect of his doing well.]

105. If a part frozen or benumbed by cold be too suddenly warmed, severe inflammation is the result; the part swells, becomes red and blue, and active throbbing pain ensues—*chilblains;* pouring out of fluid into the cellular tissue, suppuration, and, in actually frozen parts, *gangrene.* Corresponding appearances occur on the whole body if warmth be applied after exposure to severe cold; the skin swells, becomes red and painful, red spots, gorging with blood in different parts, and, in consequence, swimming of the head, swooning, spitting of blood, inflammation of the lungs, and so on. The hasty warming of a thoroughly benumbed body produces death and rapid putrefaction.

[**Astley Cooper** observes on this point:—"Great care must be taken in these cases not to apply heat very suddenly; even the common heat of the bed frequently occasions inflammation, which is extremely liable to gangrene, in consequence of the diminished nervous influence of the part:" and he mentions the case of a person who "had been shooting, and had exposed himself to severe cold; and finding his feet benumbed on his return, he immediately put them into warm water. The consequence was that a gangrene took place, of which, notwithstanding every care, he died." (p. 216.) **Larrey** also observes that those soldiers who had been exposed to severe cold, and had opportunities of warming themselves, suffered most. The cases just related confirm these statements.]

106. In reanimating a frozen person we must always commence with the lowest degree of warmth. The frozen person should be brought into a cold room and covered up (after he is undressed) with snow or with clothes dipped in ice-cold water; or he may be laid in cold water, so however that his mouth and nose are free. When the body is somewhat thawed, there is commonly a sort of icy crust formed around it; the patient must then be removed, and the body washed with cold water mixed with a little wine or brandy. When the limbs lose their stiffness and the frozen person shows signs of life, he should be carefully dried; put into a cold bed in a cold room; scents, and remedies which excite sneezing, are to be put to his nose; air is to be carefully blown into the lungs if natural breathing do not come on; clysters of warm water with camphorated vinegar, tickling the throat with a feather, dashing cold water upon the pit of the stomach. He is to be brought by degrees into rather warmer air; mild sudorifics, elder and balm tea, with solution of acetate of ammonia, warm wine and so on, are to be given, in order to cause gentle perspiration.

107. In a similar way a frozen limb is to be thawed; it is to be rubbed with snow or dipped in cold water, till sensation and motion return, when it may be washed with camphorated spirit, brandy, petroleum or essence of amber; cold, mild sudorific tea may be given to the patient, who is to be put to bed in an unwarmed room, with a view to keeping up a gentle perspiration for several hours.

Frozen parts must always be handled with care, and no violence used, because they easily break.

108. When by hasty warming a frozen limb becomes much swollen, painful, red, blue, or in some parts even black and shrivelled like a mummy, and to outward appearance is mortified, it may, however, still be oftentimes recovered by the application of cold, and by gradual transition to warmth. But, if *mortification* have already taken place, its usual treatment must be employed. If superficial, the slough separates; but, if the whole mass of the limb be affected, so soon as the mortification is defined, amputation must be performed.

In many cases the mortified limb drops off, of itself, or the bone only has to be sawn through at the point of demarcation. It does not, however, follow that in this mortification amputation is to be rejected. My own opinion as to the fortunate results of amputation performed at the proper time, and the disadvantage of delaying it, agree with those of **Larrey** (*a*).

109. *Chilblains* (*Perniones*, Lat.; *Frostbeulen*, Germ.; *Engelures*, Fr.) are erysipelatous inflammations of the skin, which, according to their degree, are accompanied sometimes with slight swelling and sensation of heat and pricking, which after a little time often subside of themselves. Sometimes they are connected with considerable dusky-red or bluish swellings and severe pain; sometimes with excoriation, arising from

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(*a*) As above, 72.

little blisters or risings of the skin, and are often converted into wide-spreading obstinate sores. Chilblains may also, by great neglect, become mortified. They produce, only in winter, especially in change of weather, annoyances which are often great, and even interfere with the use of the limb; but, in summer, they subside. In any dyscracy of the body they often assume a corresponding character.

[Hunter mentions "another inflammation very like chilblains, which is not very lively and is often in blotches, some the breadth of a shilling, others of the breadth of half-a-crown, and even broader, &c. This inflammation certainly arises from irritable debility; the blotches look more of a copper colour, and the skin over them is often diseased." (p. 265.) I have seen this appearance several times, and, in two or three instances, long streaks in the course of the superficial veins of the same character.—J. F. S.]

110. Chilblains usually occur in young weakly persons, and women who are not accustomed to cold, have a sensitive and delicate skin, most commonly on the feet, hands, ears, nose, and lips, by a sudden alternation of cold and heat, especially if the part be moist and sweating. In many persons there seems a peculiar disposition for their production.

111. The treatment of chilblains of a mild kind consists in frequently rubbing them with snow, in repeated washing with ice-cold water, with brandy and water. camphorated spirit, lead wash, vinegar, acetate of ammonia, solution of hydrochlorate of ammonia, tincture of amber, diluted hydrochloric or sulphuric acid, petroleum, oil of turpentine, a mixture of rectified spirit of ammonia and laudanum, nitric acid with cinnamon water, solution of chloride of lime and so on. If they are very painful, more soothing remedies must be employed, leeches on the diseased part, cocoa, butter, deer-suet, poultices of chamomile and elder flowers, of rotten apples,bruised houseleek, various softening ointments, smearing with warm glue, and so on. Rubbing in soap liniment with a portion of tincture of cantharides upon the chilblain once or twice a day and keeping it warm, and, if it be ulcerated, the rubbing is to be applied in the immediate neighbourhood (*a*). The diseased part must be kept warm and quiet during the employment of these remedies.

[One of the best stimulants for chilblains is our hospital mustard liniment, consisting of one ounce of flour of mustard to a pint of turpentine.—J. F. S.]

112. Ulcerated chilblains require drying salves, lead oinment, zinc ointment, with myrrh, camphor, opium and Peruvian balsam, red precipitate of mercury ointment, and, if the flesh fungates, it must be touched with lunar caustic. In old sores of this kind, issues must be employed before they close, and, if connected with any general disease, it must be properly counteracted. Many speak favorably of electricity.

Gangrenous chilbains must be treated after the general rules.

113. The occurrence, as well as the recurrence of chilblains, must be guarded against by accustoming oneself to the cold, by avoiding warm coverings, and all hasty warming of cold parts, by frequently washing with cold water, and afterwards brushing and carefully drying them.

(*a*) Wardrop; in Medic.-Chirug. Trans., vol. v. p. 142.

IV.—OF BOIL OR FURUNCLE.

Berlen, Dissert. de Furunculo. Gottingæ, 1797.

Heim, Erfahrungen über die Furunkeln; in **Horn's** Neuen Archiv., vol. vii. p. 151.

Jourdan,—Article, *Furoncle;* in Dictionn. des Sciences Médicales, vol. xvii.

Alibert, Nosographie des Dermatoses, vol. i. p. 221. Paris, 1832. folio.

Dupuytren; in Leçons Orales, vol. iv. p. 109.

Copeland, James, M.D.,—Article, *Furuncular Diseases;* in his Dictionary of Practical Medicine, vol. i.

114. The *Boil* or *Furuncle* (*Furunculus*, Lat.; *der Blutschwär* oder *der Furunkel*, Germ.; *Furoncle*, Fr.) is a hard, bounded, deep red, raised and very painful swelling, situated in the sebaceous follicles of the skin, occurring on all parts of the body, and usually terminating in suppuration.

A slight pain first attacks some one part of the skin, and a little swelling appears, which, as the pain increases, becomes elevated, hard, and of a deep red colour, and attains various degrees of size, rarely, however, exceeding that of a pigeon's egg. In delicate persons, and in children, or, if the boil be seated in a sensible part, febrile symptoms often arise, loss of sleep, want of appetite, convulsions and so on. The swelling becomes white at the top, it breaks, some pus mixed with blood is discharged, and then the bag of the gland together with the destroyed cellular tissue is thrown off like a grayish-white core, or *set-fast*, as it is vulgarly called, (*Eiterpropf*, Germ.; *Bourbillon*, Fr.,) after which the surrounding hardness subsides.

The sebaceous glands of the skin are not contingently attacked by the inflammation in boil, if the furuncular inflammation of the cellular tissue occur in its neighbourhood (**Walther**); but the sebaceous glands are originally the seat of the inflammation, and from them the inflammation spreads into the surrounding cellular tissue, as is proved by the little hard knot out of which the boil is always developed. The boil is only one link in the changes of the sebaceous glands, produced by inflammation, and only a gradual variation from the pimples and red spots so frequent on the face. These pimples, the mere inflammation of the excretory ducts of the sebaceous glands, may be always easily removed and their passage into a little pustule prevented, if they be squeezed early, which discharges a tallow-like substance from the duct. As the pimples are connected with the boil, as inflammatory affections of the sebaceous glands and their ducts, so also the maggots (*commedones*) are plugs in the excretory ducts, and the little pearl-like, almost transparent vesicles, which often occur in great numbers on the face of persons with tender skin, and which, if cut into or pulled out, present a tallowy substance enclosed in a bluish-white bag beneath the skin, to the sebaceous tumours—as chronic changes of the sebaceous glands.

[**Gendrin** (*a*) denies that cores are sloughs, but says they are morbid secretions or pseudo-membranes, the product of the inflammation of the inter-areolar cellular processes; and that they consist of a viscid semi-transparent homogeneous yellowish-white substance without any vessels and without the least trace of organization. (p. 19.)

Boils are divided by **Alibert** (*b*) into four kinds, each presenting special characters. 1. The *Common Boil* (*Furoncle Vulgaire* or *Clou*) described above. 2. The *Wasp's-Nest Boil* (*Furoncle Guêpier*) is also called by some the *Malignant Boil*, and by others the *Mild Carbuncle*, though they only described *Malignant Carbuncle:* the two diseases, however, appear to **Alibert** decidedly distinct, and justify their separation and the arrangement of the so-called mild carbuncle with boils, of which, indeed, it is merely an agglomeration, indicated by a hard tumour surrounded with a red and inflamed zone, and having its top covered with one or more vesicles which shew its serous character: the pain is severe, the heat pungent and burning; pulsation and fluctuation are soon felt; the skin thins, and, numerous perforations being formed, a kind of grayish sanious skin separates in flakes, or may be removed in pieces, and the tegument covering the tumour separates during its course. This form of boil generally attacks the nape and region of the neck,

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(*a*) Above cited, vol. i.

(*b*) Quoted at the head of the article.

sometimes extends to the back and rump, and even occasionally attacks the upper limbs. When the parts confining it are set at liberty, large ulcerations occur. It is generally critical; specially occurs after gastric and adynamic affections; rarely attacks other than elderly persons, and hence has been called *Old People's Boil.* According to MALVANI, its course is less quick than that of the common boil; it suppurates more slowly, for vesicles do not appear on it till the third or fourth week. 3. The *Pustular Boil* (*Furoncle Panulé*) is a slightly elevated but wide swelling similar to a pustule. It is acccompanied with pain, distension, and often with slight fever. It proceeds very slowly, requiring many months, and even a year to bring it to perfection. The aperture on its top resembles that of a weaver's shuttle; subsequently the boil dries up, and, if scratched, falls into powder. It occurs in all parts of the body, and, on its subsidence, leaves an ecchymosed spot, similar to that which ushers in its appearance. Its tip is generally red, hard, very shining, and gives place to a slight serous exudation, which ceases for some time, is repaired at intervals, but the hardness continues and is only resolved by furfuraceous scales. 4. The *Asthenic Furuncle* of Dr. COPELAND (*a*) (*Furoncle Atonique* of GUERSENT) (*b*) was described in the spring of 1823 by both those physicians. They agree in having observed it in children previously much weakened by disease; in persons who are subject to gastro-enteritis with adynamic symptoms; in latent pneumonia, during the course of small pox, and so on, according to GUERSENT, and where the weakness has been caused by chronic disorder of the bronchi, or asthenic inflammation of the substance of the lungs, according to COPELAND, who adds that coma generally comes on before death, in addition to the well-marked symptoms of adynamia noticed by him and GUERSENT. The eruption appears chiefly on the trunk, the lateral parts of the neck and thighs, but, GUERSENT says, more rarely on the limbs. COPELAND states, that in the cases he has observed, " the number of furuncles has been considerable, not fewer than five or six, and in two cases they were about twenty. GUERSENT'S paper, however, does not lead to the supposition that in his cases the furuncles were numerous. Both describe them to begin as circumscribed swellings, of little extent, but resistant to the touch, of a livid violet colour, but sometimes without any remarkable change in the colour of the skin. In the second stage, a very small purulent phlyctæna appears on the top of the swelling, and, when it tears, the true skin shows beneath a little grayish patch, softened and perforated through and through like a common boil. At first a bloody serous fluid exudes, the swelling softens, and the aperture in the skin enlarges, which in two or three days, and sometimes even in twenty-four hours, forms a perforation from five to six lines in diameter, completely round, and exactly like a hole which has been made with an auger. During this time the swelling rapidly subsides. The cellular tissue does not separate like a core, and rarely detaches some fragments. The bottom of the ulcer presents a grayish sanious and dryish appearance, and whilst its edge is well defined, the surrounding skin, paler and softer than natural, is entirely separated from the cellular tissue to the extent of several lines. This atonic furuncle very commonly follows leech-bites; the perforation in the skin then seems to have been made with a trocar, but this triangular form soon rounds as it spreads, and becomes completely circular, as if it had arisen spontaneously. If the leech-bites have been grouped together, and each bite have given rise to a little furuncle, the skin after a few days appears perforated at every bite, and resembles a suppurating carbuncle, but with this difference that there is neither fulness nor swelling, and that the holes are larger and more regular than in carbuncle, such as might be made by small shot. The ulceration, which is the third stage of atonic boil, is generally indolent; in some cases, however, it is painful. It remains stationary for eight or ten days, more or less, according to the general condition of the patient. When the ulcer is disposed to heal, the cellular tissue becomes moist, brightens, and becomes slightly reddened, the skin gradually attaches itself to the subcutaneous tissue; some fleshy granulations rise from the bottom of the ulcer; the aperture in the true skin diminishes a little, and, as in all ulcers of the skin, a soft scar, slightly depressed, is produced, and which, in its extent only may be compared to that succeeding a large vaccine pustule." (pp. 337, 8.) In addition to these observations of GUERSENT, it is noticed by COPELAND that the cellular tissue is destroyed by rapid ulceration or phagedenic absorption; that the ulcers have no discharge nor any tendency to scab; that, in the two cases he examined after death, no attempts at reparation were visible in the ulcerated perforations, nor any injections nor inflammatory appearances in the margins: the chief alterations were moderate emaciation, congestion, and injection of the membranes of the brain with slight serous effusion, congestion of the substance of the lungs, with limited hepatization in an early

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(*a*) Above quoted.

(*b*) Du Furoncle Atonique; in Archives Générales de Médecine, vol. i. Jan., 1823.

grade; patches of injection in the digestive mucous membrane, other parts being pale; and enlargement of the mesenteric glands. * * * The perforations are always uniform in character, although varying somewhat in size; they are peculiar and hardly ever modified from the state described; they appear analogous to the perforating phagedenic or atonic ulcers sometimes seen in the stomach. (pp. 1054, 55.) GUERSENT further remarks, that "this disease is evidently allied to the boil in its first and second stages by its form and mode of opening: the softening and sinking of the tumour after suppuration, and the absence of core, approximate it to certain kinds of atonic abscess; but the other characters do not permit their arrangement together. Finally, it is distinguished from all other cutaneous inflammations by the round and regular form of the ulcer which succeeds it. The kind of perforation has something specific; it can only be compared to the spontaneous opening of the atonic abscesses sometimes noticed on the sides of the neck, in which serous bad pus has long separated the skin before it softens it. The opening of those abscesses, often very large, and increasing as rapidly as atonic furuncle, independently of their difference in the first stage, never exhibit those regular ulcers seen in atonic furuncle." (p. 338.)]

115. The boil often occurs in healthy persons without any apparent cause. It frequently appears in convalescence after severe fever, is not unfrequently critical; after suppressed perspiration from neglect of cleanliness of the skin, in persons who live irregularly; during menstruation, and in the spring. Boils often appear, probably dependent on the state of the atmosphere, especially in young persons, in great number, at greater or less distance, in different parts, and are commonly accompanied with severe fever. After the misuse of mercury, persons with deteriorated juices, syphilitic, scrofulous and scorbutic, are frequently subject to boils. In these cases they are often chronic, attended with little pain and tedious in suppurating.

116. The treatment consists in furthering suppuration, for which purpose, in very painful boils, softening poultices with the addition of henbane, bruised poppy heads, or, in moderate inflammation, roasted onions, flour and honey, the *empl. de cicut. c. ammoniaco*, the *empl. diachylon. comp.* are used. In most cases the boil opens itself, or it may be opened with the lancet, the slough or core separates by the use of softening bread poultices, which should be continued till all hardness subsides. If any hardness remain, it is usually only dispersed by a fresh inflammation and suppuration, which we must endeavour to excite. If the boil be accompanied with very painful tension, this may be relieved and the entire course of the disease cut short by an incision throughout its whole length, and the use of softening poultices.

[In treating boils, as in the treatment of carbuncles, it is certainly best to cut across them at once, freely and deeply; the momentary pain is severe, but the relief from the violent pain under which the patient suffers is almost immediate; the tension of the part is at once relieved, the cellular tissue being enabled to discharge the serum with which, intermingled with adhesive matter, it is loaded, and thus its destruction is arrested, and the increase of the core put a stop to, and not unfrequently even does it entirely disappear, so as to render it doubtful whether it have been formed. Almost immediately after the slough or core has been thrown off, a very free flow of serum takes place from its boundary walls, and, in strong constitutions, within a few hours, the large hole from which the slough had escaped, and the surrounding swelling disappear, by the dropping down of the skin and cellular tissue to its own natural situation, leaving only an aperture in the skin which speedily scabs and heals. It is a very common but very improper practice to use stimulants, either in the shape of poultices or plasters. Generally moist warmth, kept up by poultices, by steaming, or wet flannel covered with oiled silk, is most grateful to the patient's feelings; but, in some cases, dry warmth, either with repeated hot flannel, or chamomile flowers in a flannel bag, gives most ease before the boil is opened.—J. F. S.]

117. General treatment in boils is rarely necessary; if connected with gastric impurities, or with acidity, as a cause, these must be corrected by suitable remedies in addition to the local treatment.

Ritter has a one-sided notion of the origin of boils from retention of the animal refuse, and of their dispersion by the early application of cupping-glasses (*a*).

[I do not agree with **Chelius** that general treatment in boils is unnecessary; when such is the case it is the exception, not the rule. Most commonly the general health is disturbed, and requires putting to rights by attention to the hepatic functions, and the proper employment of tonics.—J. F. S.]

V.—OF CARBUNCLE.

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118. *Carbuncle* (*Carbunculus*, *Anthrax*, Lat.; *der Karbunkel*, Germ.; *Charbon*, Fr.) is an inflammation of the skin and underlying cellular tissue, with considerable hard swelling, which runs into gangrene throughout its whole extent. It is distinguished from boil only by the severity of the inflammation and by its great disposition to run into gangrene; and from malignant pustule (*par.* 34), with which it has great similarity, and has been by many confounded, in that the latter is always the consequence of an imparted peculiar poison.

Under an attack of severe burning pain, a circumscribed hard swelling is produced, on which numerous pustules arise; these bursting, many sieve-like holes are formed in the skin, from which bloody ichor escapes, and at the bottom of which mortified cellular tissue is seen; the skin grows dark, blue, or black, and quickly runs into gangrene. Sometimes the deep parts are all in a state of mortification before it appears externally. If the skin be destroyed by running together of several apertures, or by mortification, the dead cellular tissue appears as a whitish-gray lump, or, in large carbuncles, as a black, dry mass intermixed with grayish-white and bloody shreds, with great surrounding inflammation, which runs into suppuration, in which case, after the throwing off of the dead cellular tissue a large ulcer is produced, at the bottom of which muscles, tendons, bones and even more important organs, are laid bare. The size of the carbuncle is very different, often as large as the hand, often still larger. It usually occurs on the neck, between the shoulder-blades, upon the back and buttocks. Fever very commonly precedes carbuncle, or accompanies it from the first; and is sometimes only slight, sometimes nervous, putrid and so on. Hence arises the difference between *symptomatic*, *malignant*, *pestilential*, *idiopathic*, and *benignant* carbuncle.

["The inflammation that produces the carbuncle is," says J. **Hunter**, "of a different nature from any of the former; it is stationary with respect to place, and is pretty much

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(*a*) In Journal von **Graefe** und von **Walther**, vol. iii. part. i. p. 81.

circumscribed, even forming a broad, flat, firm tumour; it begins in the skin, almost like a pimple, and goes deeper and deeper, spreading with a broad base under the skin, in the cellular membrane; and, although considerably tumefied, yet this does not arise from the extravasation of coagulating lymph producing adhesions which are to retain life, for the very cells into which it is extravasated become dead. It produces a suppuration, but not an abscess, somewhat similar to the erysipelatous, when the inflammation passes into the cellular membrane; for, as there are no adhesions, the matter lies in the cells where it was formed, almost like water in an anasarca; but still it is not diffused through the uninflamed cellular membrane, as in the erysipelatous, for it appears to extend no further than the inflammation. One would almost imagine that there was a limitation to the extent beyond which this species of inflammation could not go, and at these limits the adhesive inflammation took place to confine the matter within the bounds of the carbuncle. A diffused ulceration on the inside, for the exit of the matter, takes place, making a number of openings in the skin." (pp. 272, 3.)

HUNTER's observations, that "there are generally more carbuncles than one at the same time, a great number succeeding each other, which would almost seem to produce each other in this succession," I cannot, from my own observation, confirm. Generally I have noticed them to occur singly, but occasionally there may be more.—J. F. S.

The carbuncle "appears," says the same writer, "to have some affinity to the boil; but the boil differs in this respect, that it has more of the true inflammation, therefore spreads less, and is more peculiar to the young than the old, which may be the reason why it partakes more of the true inflammation." As to the causes of the disease he observes:—"As death is produced in a great deal of the cellular membrane, and, I believe, in it only, except the skin giving way, which I believe is by ulceration principally, it becomes a question whether this mortification arises from the nature of the inflammation, or rather from the matter being confined in the cells of the cellular membrane? I suspect the latter; for, I find that if this matter escapes from these cells, and comes into uninflamed cells, it produces mortification there." (pp. 273, 4.)

COPELAND (*a*) well observes:—"Anthrax rarely occurs excepting in habits of body evincing more or less cachexy, with sanguineous plethora, and disorder of the digestive functions. For some days before its eruption, the patient complains of anorexia and increased disorder of these functions, and of lassitude, chills, or shiverings. With the development of the tumour the febrile commotion increases, and presents the usual concomitants of inflammatory fever. If sphacelation takes place, or if the ulceration is protracted, the attendant fever assumes gradually an adynamic character; and, in delicate, old, or very cachectic persons, it is nervous or adynamic from the commencement." (p. 1055.)

PERREZ (*b*) gives the following account of the physiology of carbuncle:—"The malignant carbuncle of ontologique authors is a violent inflammation of the tegument and subcutaneous cellular tissue, produced from an irritation pre-existing in some organ, and most commonly in the organs of digestion, whence it is conveyed to the tissue where the carbuncle is developed. The irritation causing this inflammation is so active and severe that it is almost impossible to prevent the production of gangrene in a more or less large part of the tissue it attacks; but we may, by prompt and powerful antiphlogistic means, arrest the progress of this inflammation, and thus stop the gangrene and other consecutive symptoms. Whatever be the organ whence the irritation causing carbuncles springs, the violent pains, of which the inflamed part is the seat, may reproduce a more or less severe irritation, exasperate that which already exists, and produce in some organ, but most commonly in the stomach, a fresh irritation, all of which may become dangerous if not physiologically contended with. * * * If an irritation be established in an important organ it produces the following effect on the carbuncle:—the irritation, which has caused the latter will be repelled by that of the recently affected organ; the carbuncle becomes pallid, the pains diminish, but the new irritation will increase, and with it the patient's danger. This must be put a stop to, and then the inflammation will reappear on the skin, or even, according as the remedies employed have diminished the disposition to irritation, the inflammation may not reappear. The carbuncle will be averted without the complete cure of the patient being retarded. In some rare instances, this same disposition to irritation will be so great, that the carbuncle and the secondary irritation which it has brought back, exasperated, or produced, will co-exist with equal intensity. The gorging caused by the inflammation is sometimes so considerable, and so very rapid, that it cannot be stopped quickly enough, neither can the tissues stretch sufficiently to avert the strangulation of the gorged parts, and hence results gangrene." (pp. 585, 6.)]

(*a*) Above quoted.

(*b*) Observation d'un Anthrax ou Charbon Malin, traité physiologiquement et guéri; in BROUSSAIS' Annales de la Médecine Physiologique, vol. vii. Paris, 1825.

119. *Benignant Carbuncle* frequently occurs without manifest cause, even in healthy persons; commonly in poor persons, who live in unhealthy neighbourhoods, eat bad food, and are very much reduced by preceding disease; also with impurities of the bowels. Carbuncle is in most cases the consequence of metastasis of deleterious matter (rheumatic or gouty.) It takes place at every age, in either sex, at every season of the year, but especially in the great heats of summer. The *Malignant Carbuncle* is never connected with previous fever.

[English surgeons generally do not hold with the metastatic origin of carbuncle, but believe it rather dependent on disturbance of the digestive organs, or on general disturbance or break-up of the constitution. Thus, it is often noticed in women on the subsidence of menstruation, but more commonly in elderly men who have lived freely and worn their constitutions out. RAYER says that carbuncle occurs most frequently in spring and summer; and our author that it happens especially in the great heats of summer. I have not, however, observed it more common at one than another time of the year.—J. F. S.]

120. The danger of carbuncle depends on its size, seat, on the presence of many such swellings, on the constitution of the patient, and the general disease connected with it.

[ASTLEY COOPER observes:—"Carbuncle generally does well, except when situated on the head or neck. Though persons recover from carbuncles of an enormous size upon the back, yet very small ones on the head or neck will often destroy: indeed, I never saw a patient who recovered from any considerable carbuncle upon the head; in these case there is effusion upon the brain, producing compression." (p. 243.) Carbuncle on th head is rare; I have not seen above two or three cases of it.—J. F. S.]

121. In the *Benignant Carbuncle*, the internal treatment is always guided by the difference of the fever and the cause of the carbuncle. A strict antiphlogistic treatment is rarely indicated, but rather in most cases a mild sudorific treatment, emptying of the intestinal canal, emetics and the employment of dilute mineral acids. When the powers of the patient sink, which always happens on the occurrence of mortification, a more strengthening treatment is needed.

122. The local treatment consists in making very early a cross cut of sufficient depth, by which the constriction of the cellular tissue is relieved. The wound is to be bandaged with stimulating digestive salves, the sloughy cellular tissue to be removed, and an endeavour made to produce good suppuration. If sloughs have formed, still the cuts must be made, or the previous openings enlarged, the sloughs removed, (which treatment is preferable to the use of the actual cautery, butyr of antimony and other caustics,) in order to make an escape for the gangrenous juice, collected beneath them, and to prevent its acting on the whole organism. The further treatment is to be after the rules laid down for gangrene. It is not true that merely softening poultices do harm, and favour the progress of the disease, and repeated experience has proved to me, that, after proper division of the carbuncle by a cross cut, the cure is effected most simply by the continued use of softening poultices.

That cutting into the carbuncle is generally neither necessary nor useful (VON WALTHER) is the most dangerous statement which can be put forth in the treatment of carbuncle. I have often satisfied myself that it was possible by an early cut to preserve the skin, the edges of which, after separation of the mortified cellular tissue, soon healed up; and it is possible only by a proper cut to form an outlet for the collecting gangrenous juice and the dead cellular tissue.

[The practice of cutting deeply into carbuncles is of long standing in this country. WISEMAN, (a) one of our early writers on Surgery, says:—"I advise scarifying or cutting deep into it, (the carbuncle,) to give a breathing to the humour." And perhaps it may be, that to this practice must be attributed the cause of his very remarkable, and to us almost incredible statement:—" I never saw a true carbuncle suppurate." (p. 87.)

(a) Eight Chirurgical Treatises, vol. i. London, 1734.

Bromfield (*a*) recommends injections of bark and tincture of myrrh, but also "strongly inculcates the necessity, at a proper time, of making an opening sufficient to draw out the slough; for, in case you rely on that opening which is generally made by nature, the thin matter only will be discharged, and the sloughed or flocculent membranes will remain, and the orifice close up. When this is the case, how greatly detrimental at present, as well as troublesome in future, it may prove to the patient, every practitioner in Surgery can declare." (p. 129.)

The free incision of carbuncle, generally in a crucial form and deep, was also recommended, years since, by **Cooper**, **Abernethy** and most other English surgeons, **John Pearson** almost alone excepted, for the purpose of relieving the tension of the skin, and thereby diminishing the chance of its destruction, by the burrowing into the neighbourhood of the pent-up ill-conditioned pus, as well as that of the subjacent cellular tissue; so that, although **Dupuytren** has rather more pointedly stated, that "the treatment, like that of all inflammations with strangulation, consists in the methodical employment of incision which must go to the bottom of the carbuncle, and of which the ends must pass two or three times beyond its boundary," (p. 112,) yet our French friends have no right to claim either for him or for **Rayer** the origination of that practice.

After the incisions have been made, stimulating poultices of either port wine, stale beer grounds, or yeast with linseed meal, should be employed to hasten the separation of the slough; which effected, the large hole caused by its voidance must be treated with a common poultice, to encourage granulations; and, if these be sluggish, some gentle stimulant, as lint dipped in nitric acid wash or black wash, may be laid on the sore and covered with the poultice.—J. F. S.

Physick (*b*), of Philadelphia, U.S., recommends, as highly beneficial, the application of caustic vegetable alkali in quantity sufficient to completely destroy the skin when, in the second stage of the disease, the appearance of pimples and small orifices show that the process of making an opening through the skin to allow the dead parts and acrid fluids to pass out has commenced. "In all the cases in which he has used the caustic in this manner," he observes, "the sufferings of the patient ceased as soon as the pain from the caustic subsided. It operates by destroying in a few minutes that portion of the skin covering the mortified parts which, if left to be removed by ulceration, would require several days for its completion, occasioning the chief part of the pain and danger attendant on and consequent to the disease." (p. 175.) If it were necessary for the cure of the disease that the skin covering the dead cellular tissue should also die, then **Physick's** practice would be very satisfactory. But, as the object is to save the skin, which cannot, however, always be effected, though it ought always to be attempted, and in most cases is managed by making incisions through it early, and so relieving the tension which causes the sloughing of the skin, then **Physick's** treatment is decidedly improper.

The use of blisters in carbuncle was also first proposed by **Physick**; but he now doubts their value. He says:—" From the great power of blisters in checking mortification, when proceeding from some kinds of inflammation, I once entertained high expectations of their utility in the treatment of anthrax. But, though I have found them serviceable in abating the burning pain attending the inflammation, they have not shown any power in counteracting its progress to mortification." (p. 179.) **Coates** (*c*), however, thinks "Still there is evidence enough to show that these remedies (*epispastics*) possess a high value in certain cases. * * * Although they may sometimes accelerate rather than retard the mortification of the centre of the tumour, where they very seldom produce vesication, they appear to circumscribe the inflammation, and thus prevent the extension of the disease. (p. 30.) The commencement of the second stage," he says, "is the most suitable time for the use of blisters, and the most fitting cases those where the extent and the situation of the swelling preclude the knife." He also mentions a case in which almost immediately a blister caused a complete line of demarcation where the mortification of an anthrax of the worst kind was spreading rapidly. The swelling was situated on the first cervical vertebra and extended some inches on the scalp, very dangerous cerebral symptoms came on, but yielded readily to the blister. (p. 30.)

(*a*) Quoted at the head of the article.

(*b*) Case of Carbuncle, with some Remarks on the use of Caustic in that disease; in **Chapman's** Philadelphia Journal of the Medical and Physical Sciences, vol. ii. Philadelphia, 1821. 8vo.

(*c*) **Hays'** American Cyclopædia of Practical Medicine and Surgery,—article *Anthrax*, vol. ii. Philadelphia, 1836. 8vo.

Perrez (*a*), who is a disciple of **Broussais**, does not consider incision of a carbuncle sufficient unless it produces free bleeding, and, if it do not, then leeches are indispensable, "the incision merely putting an end to the mechanical cause which adds to the existing irritation; and the latter continuing after, although much diminished by the separation of the slough, requires a persistence in the antiphlogistic remedies to lessen still further and to put it out completely. Marsh-mallow or linseed-meal poultices must be used, and if, from any cause, the inflammation be re-excited, local and general means must be had recourse to. In the case which **Perrez** mentions as having treated on these principles, the advantage gained does not seem so great as he would wish to be inferred. On the first day thirty leeches and on the second fifteen leeches were applied, and the carbuncle covered up in boiled marsh-mallow poultices. The patient was strictly debarred from all solid or liquid food for three days, during which time she was, being of a nervo-sanguineous temperament, well drenched with a quantity of acidulated and gummy drinks. In the following days the sloughs separated, and, as usual, the pain almost entirely subsided. A short time after, the surface again inflamed, leeches were applied around, the wound did well, but, from the recital of the case, although not positively stated, probably not very quickly.

The older surgeons, and even **Pouteau**, employed caustic, and even the actual cautery; but both practices are now completely exploded.]

123. The *Malignant Carbuncle* requires, especially, the proper treatment of its accompanying fever, and the local application of stimulating poultices, even of the actual cautery, or other caustics, if the swelling will not proceed: the other treatment agrees with that already described.

THIRD SECTION.—OF INFLAMMATION IN CERTAIN SPECIAL ORGANS.

I.—OF INFLAMMATION OF THE TONSILS.

Le Cat, C. L., Mémoire sur l'Extirpation des Amygdales Squirrheuses, in the Journal de Médecine, vol. ii. p. 115. 1755.

Louis, Sur la Resection des Amygdales Tuméfiées, in the Mém. de l'Académie de Chirurgie, vol. v. p. 423.

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Perrin, N., Diss. sur la Rescission des Amygdales, Paris, an XIII. 4to.

Lehwehs, H., Diss. de Scirrho Tonsillarum. Berol., 1817. 8vo.

Chevalier, Thomas, Description of an improved Method of tying Diseased Tonsils, in Med.-Chir. Trans., vol. iii. p. 80.

Physick, Ph. Syng.; in Philadelphia Journal of the Medical and Physical Sciences, vol. i. 1820, November, p. 17.

Lisfranc, Considérations anatomiques, physiologiques et pathologiques, sur la Luette, in Révue Médicale, July, 1823.

Chollet, Des Moyens Chirurgicaux appliqués au Traitement de l'Amydalité. Paris, 1827.

124. *Quinsy*, or Inflammation of one or both Tonsils, (*Angina Tonsillaris*, Lat.; *Kehlsucht*, Germ.; *Esquinancie*, Fr.,) when accompanied by much swelling, interferes with swallowing and breathing; the patients speak through the nose, and are much troubled by the phlegm which collects in the throat. Not unfrequently there is singing and pain in the ears, from closure of the Eustachian tubes. The swollen tonsils are felt beneath the jaw, and seen distinctly when the patient's mouth is opened and the tongue thrust down; and the swelling is often so great as to block up completely the passages of the throat. More or less active febrile symptoms are present, according to the degree of the inflammation.

(*a*) As above.

125. This inflammation originates most commonly from cold in delicate persons unused to exposure to the air, also from any severe irritation of the throat, from spreading of the inflammation from other parts, from the venereal disease, from eruptions of the skin, and so on.

126. In most cases the inflammation of the tonsils is *resolved;* not unfrequently it runs into *suppuration* less indeed as consequence of its own activity than of a peculiar disposition which inflammations of the throat in many persons have to pass into suppuration, more especially if former attacks of the kind have terminated in a similar manner. This may be looked for when the inflammation of the throat has existed for several days with uniform severity, when the sensation of pressure in the throat becomes greater and much mucus is collected therein. The passing into *hardening* is never observed in active, rapid inflammation of the throat, but when it creeps on slowly and recurs frequently; the consequence of which is, a *growth* (or hypertrophy) of the parenchyma of the tonsil gland rather than an actual hardening. The passage into *gangrene* is always dependent on a malignant character of the accompanying fever, and is extremely dangerous.

[Abscess in the tonsil having once occurred, is very commonly again and again produced whenever inflammation attacks the gland, and so quickly that any attempt to prevent its formation is useless, the inflammation rushing, as it were, headlong into suppuration. During its course the agony and inconvenience are very great; but, on the bursting or opening of the abscess, the symptoms as suddenly cease.

Dr. TWEEDIE (*a*) says, that although enlargement of the tonsils results from repeated attacks of inflammation, " it is, however, in some instances congenital, and occasionally appears to be hereditary, and in such individuals it is often associated with traces of the strumous diathesis. The enlargement generally exists without induration of the tonsil, more especially when it occurs in young persons: when it arises as a consequence of inflammation, and more particularly in elderly people, the enlargement is generally accompanied by induration." (p. 185.)

Gangrene of the tonsils is very rare, and in the two cases, both fatal, mentioned by GUERSENT (*b*), it was only attendant on more important disease. In the first case the tonsils appeared to be attacked simply with severe inflammation, and were fortunately relieved by antiphlogistic treatment; but subsequently they became livid, produced a secretion resembling wine lees, and very offensive, and on the seventeenth day the patient died. On examination, besides softening and black or dark-grayish disorganization of the tonsils and soft palate, the same change was found in a portion of the right lung. In the second case, the tonsils were at first but slightly inflamed; on the third or fourth day, however, they assumed a brownish colour, and a very offensive smell, and when cut into were not painful. The patient gradually sunk with vomiting and severe gastro-enteritis, but unaccompanied with much febrile excitement. After death the mucous membrane of the stomach and part of the small intestines were bright red, and in the former covered with a white soft elastic false membrane. (p. 134.)]

127. The *treatment* differs according to the activity of the inflammation and the accompanying fever. In slight inflammation mild diaphoretics are of service, as elder and lime-flower tea, solution of acetate of ammonia, hydrochlorate of ammonia, and so on; in the more active degree, bleeding, application of leeches, nitre in emulsion, calomel. For bathing the inflamed part soothing decoctions are used in form of gargles or injections, which latter more readily clear away the mucus and do not produce any straining of the parts. The inhaling of warm soothing vapours also serves the same purpose.

[Dr. WATSON (*c*) says the only gargle he considers " admissible in the commencement of the malady, is a gargle of warm milk and water. * * * But far better than any-

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(*a*) Diseases of the Throat; in Cyclopædia of Practical Medicine, vol. iv.

(*b*) Dict. de Médecine, vol. ii.—Article, *Angine Gangreneuse.*

(*c*) Lectures on the Principles and Practice of Physic, vol. i. London, 1843. 8vo.

thing else, as a local application to the inflamed fauces, is the steam of hot water; whether we are hoping for resolution of the inflammation, or whether we desire to promote and hasten the process of suppuration already begun. * * * The most convenient and effectual inhaler is that of Hercy, from which a large volume of steam is carried inwards against the fauces by the mere natural breathings of the patient." (p. 790.)]

128. In great swelling of the tonsils *scarifications* are specially useful; these are made with the palate-lancet or with a common bistoury, the edge of which is guarded nearly to the point, or with the *pharyngotome.* The patient is to be placed so that the light may fall into his mouth, which is kept open by thrusting a piece of cork between the molar teeth; the tongue is pressed down with a spatula, and shallow cuts are made with the instrument just mentioned into the swollen tonsils. The bleeding is to be promoted by soothing luke-warm gargles.

[In scarifying the tonsils, there is danger of wounding the carotid artery, or some branch, which will continue bleeding and cause serious alarm. Watson mentions in his Lectures a case of fatal bleeding from wound of the internal carotid artery:—"Only a very few years ago, in Ireland, it was struck by a surgeon while scarifying a gentleman's tonsil, and he died in three minutes." In another case, which occurred under Watson's own care in 1838, in which the tonsil glands, during convalescence from scarlet fever, having become so enlarged as to impede breathing considerably, "the surgeon in attendance punctured the tonsils. The next day a good deal of hæmorrhage took place; and this recurred several times, to a considerable and even alarming amount. When the clots that formed were wiped away with a sponge, the blood could be seen welling out in a little stream, with a pulsating motion, from a small incision in the left tonsil. The hæmorrhage was ultimately, after much trouble and anxiety, arrested, by applying a pencil of lunar caustic freely within the bleeding orifice." (p. 792.)

I believe, in such a case, the use of the actual cautery would be preferable to any other remedy, and should certainly employ it if opportunity occurred.—J. F. S.]

129. When the inflammation subsides, but the swelling still continues, astringent remedies, as the *liquor ammoniæ acetatis*, hydrochlorate of ammonia, sage, vinegar, and so on, are to be added gradually to the gargles, by the proper employment of which the disposition of the parts to chronic inflammation is prevented.

130. When an *abscess* forms in the tonsil, which can be distinguished by the above-noticed signs (*par.* 126), by fluctuation on touching the tonsil with the finger, and often by the pus itself showing through, and it does not break of itself under the use of softening gargles, great danger of suffocation, or burrowing of the pus, is to be feared; and it must then be opened with a guarded bistoury, or the pharyngotome, used as in scarification of the tonsils. Irritation of the throat, and straining by vomiting, often effect the bursting of the abscess. After the pus has been discharged, soothing gargles with honey are to be frequently used, and commonly produce a speedy cure. In rare cases the abscess penetrates externally beneath the jaw, and then must be treated as common abscess.

[In reference to the spontaneous bursting of abscess in the tonsil, which generally occurs between the pillars of the fauces, Allan Burns (a) observes:—"But Dr. Brown has informed me that in two patients it burst through the *velum palati.* In both these cases, the sore formed very much resembled a venereal ulcer, and, without great care, in tracing the origin and progress of the disease, would have been mistaken for a venereal affection. I may also mention," he continues, "that where the chief prominence in abscess of the tonsil is seen, not between the pillars of the fauces, but on the fore part of the *velum*, it is not to be expected that the tumour will point as in external suppurations. On the contrary, the pus will continue long deep-seated, and, were the surgeon to delay, in the expectation that it would become more superficial, the patient, before this event took place, would be suffocated. So soon, therefore, as the difficulty of breathing renders it necessary, an opening is to be made in the abscess, and that even where the matter is still deep-seated; but fluctuation, generally obscure indeed, must be felt, before we presume to thrust an instrument into the tumour. If this point be not fully ascertained, a polypus may be mistaken for an abscess of the tonsil." (p. 255.)

(a) Observations on the Surgical Anatomy of the Head and Neck. Edinburgh, 1811. 8vo.

Burns considers that the bursting of a tonsillar abscess is attended with much danger. He says:—"Whenever the abscess bursts, the mouth and fauces are filled by a gush of matter, every obstruction to the free entrance of the air is suddenly removed, the patient fetches an involuntary and deep inspiration, air and matter rush together into the trachea, and death, from suffocation, is almost the immediate consequence." And, in support of this statement, he mentions the case of a strong, active, young man who thus lost his life:—"He had been complaining for a few days of a sore throat, for which he had consulted his surgeon, who had employed the usual remedies. The inflammation terminated in suppuration; the abscess enlarged, till, at length, the tumour occupied almost entirely the fauces; yet, ten minutes before his death, he was walking about the house, restless indeed, anxious, and gasping for breath. The bursting of the abscess and death followed each other so rapidly, that no measures could be taken to prevent the latter event. The cause of death was not conjectured in this instance. The body was examined, and the trachea found deluged with purulent matter. To prevent a similar accident, it would be advisable, where the tumour is large, and the difficulty of breathing great, to puncture the abscess as we would do a hydrocele. Were the matter evacuated through a canula, there would be no risk of its finding way into the windpipe, and, if the stilet were made to project only a little beyond the canula, the trocar may be as safely used as any other instrument." (p. 257, 8.)

In most cases of tonsillar abscess, 'the effort of vomiting excited by emetics is generally sufficient to burst the walls and discharge the pus; but, if this treatment be ineffectual, and the patient's breathing be much interfered with, it is better to open the abscess, for which Allan Burns gives the following directions:—"One who is familiar with the parts in connexion with the tonsil, will, in entering the knife into an abscess here, take care not to direct its point in the line of the angle of the jaw; for, he is well aware, that if he do this, he may injure a large artery. He will push the instrument into the front of the cyst and carry it directly backwards, as if he intended to cut off a segment of the tumour; if he follow this course, and transfix the abscess, the worst which can happen will be injury of the back part of the pharynx, a trivial accident when compared with the effects resulting from opening a large blood-vessel." (p. 257.)

I think, however, that a gum-fleam is the most convenient instrument; its edge should be rested against the enlarged gland, as near the mesial line of the body as possible, to penetrate the swelling and then moved vertically and gently up and down, the handle of the instrument being held like a pen, till the abscess is penetrated, which in general is done quickly, and immediately the pus appears the fleam should be withdrawn. It is recommended, very properly, that the incision or puncture should be made directly backwards or from without, inwards and backwards, to avoid puncturing the internal carotid artery which might be easily done if the knife or fleam were thrust outwards.

The student is always very properly exhorted to puncture tonsillar abscess with great caution, for fear of wounding the carotid artery. But, although this operation must be often carelessly and clumsily enough performed, yet dangerous bleeding is not so frequent as might be expected; and I have only been able to collect the following authentic accounts:—

Portal (*a*) mentions a case in which, in performing this operation with a pharyngotome, "a dexterous surgeon of Montpellier had the misfortune to open a large artery, and see the patient perish of so severe a hæmorrhage that nothing could arrest it." (p. 509.) Allan Burns also says:—"In this country, (Scotland,) I have been informed that a surgeon, in opening a tonsillitic abscess, actually did plunge the knife into the carotid. I need hardly add that he lost his patient before he could suppress the bleeding." (p. 256.) My late colleague Tyrrell was accustomed to mention, in his Surgical Lectures, a case to which he was fetched by a practitioner, who, having punctured an abscess in the tonsil gland, the wound was immediately followed by severe bleeding, and the patient was dead before he could reach the house. Sir Benjamin Brodie informs me that he is cognizant of two cases in which death from bleeding ensued after the puncture of tonsillar abscess.

From the puncture of an immature tonsillar abscess, alarming hæmorrhage may occur, without, however, destroying life; for the following instance of which I am indebted to my friend Lawrence:—

Case.—"In a gentleman labouring under *cynanche tonsillaris*, a premature puncture was made, with the expectation of evacuating matter. A most profuse bleeding ensued,

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(*a*) Cours d'Anatomie Médicale, vol. v.

which stopped from the occurrence of fainting, and did not recur. It, however, not only seriously alarmed the patient and those around him, but also the gentleman who made the puncture. A long time elapsed before the patient recovered his strength."]

131. When inflammation of the throat passes into mortification, the fever especially must be treated according to its character. The local treatment consists in removing the sloughs and foul ichor from the throat by injection of decoction of bark, of scordium with alum, camphorated vinegar, and so on. Hydrochloric acid with honey applied with a pencil of charpie on the mortified part is of great use.

132. The *hardening* of the tonsils which remains after inflammation, is of a good character; it is little painful, but is commonly subject to repeated inflammatory attacks, yet very seldom does it run into cancer. It may be treated with gargles of hemlock, belladonna, hydrochlorate of ammonia, and so on; by rubbing of mercurial or iodine ointment externally upon the neck, by the internal use of hemlock and by derivation, by repeated scarifications and the frequent use of leeches. If inflammation should occur and run on to abscess, suppuration must be suitably promoted, and the opening of the abscess delayed till all hardness has subsided. In hardening of the tonsils, frequent painting during the day with fresh juice of *chelidonium*, at first mixed with honey of roses, but subsequently pure, is very efficient.

[ELSE (*a*), who, many years since, was Surgeon to St. Thomas's Hospital, denied that this so-called scirrhus of the tonsils was true scirrhus; the tonsils, in his opinion, never being affected with scirrhosity. And TWEEDIE (*b*) observes on this point:—"It is more consistent with pathological anatomy to ascribe those cases of supposed scirrhus of the tonsils to hypertrophy and induration alone." (p. 185.)

A very common attendant on enlargement of the tonsils is a disagreeable roughness of the voice; and deafness also is produced, either by blocking up the apertures of the Eustachian tubes, or by pressing against their cartilaginous part. It has also been asserted within the last few years, that enlarged tonsils are the cause, or one of the causes, of stammering, in consequence of which they have been very freely lopped by the practitioner who broached the opinion, but the success of his operations has been less than he would wish to allow (*c*).

Local treatment with astringent gargles, in these cases, is of little benefit, and painting the tonsils with nitrate of silver not much more efficacious, though it should be tried. I believe that constitutional treatment, attending to the state of the bowels, and giving occasional doses of rhubarb with calomel, or mercury and chalk, and a grain or two of sulphate of quina, twice or thrice a-day, with good diet and fresh air, is by far the most efficacious proceeding; although, whatever may be done, the tonsils, once enlarged, will, under excitement, again and again enlarge, and be very troublesome.—J. F. S.

In connexion with the inflammatory affection of the tonsils, and its occasional results, it may be convenient here to notice the formation of *calculi* in these glands, of which ALLAN BURNS makes the first mention. He says:—"It is not to be inferred that every chronic enlargement of the tonsil depends on thickening and induration of the substance of the gland; it is sometimes produced by the formation of calculi. These seldom in the amygdalæ acquire any considerable size; but their presence is productive of irritation and repeated attacks of cynanche, the inflammation generally proceeding to suppuration. After each successive discharge of matter, a solid and circumscribed tumour remains in the situation of the tonsil, where, sometimes by a probe, the calculus may be detected." (p. 261.) He mentions three cases of this disease, all occurring in members of the same family. In the first there was, during eighteen months, repeated abscess of the tonsil, which burst always externally; a regular and solid tumour was then noticed on the left side, which protruded the skin just below the angle of the jaw, and was followed by a severe attack of inflammation, which ended in suppuration, and bursting externally by eight small apertures, discharged matter during a full year. She then applied to a surgeon, who, having probed the wounds, found a calculus in the gland, and attempted its removal by an external incision, but was deterred

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(*a*) MS. Lectures on Surgery.

(*b*) Above quoted.

(*c*) On the Cure of Stammering, by the removal of the Uvula and Tonsils; in the Lancet for 1840–41, vol. ii. p. 587.

by the bleeding from completing the operation, and brought away only a small fragment. "In the course of fourteen days the calculus dropped from the tonsil into the mouth," and the patient did well. In the other two cases the calculus also escaped from the tonsil into the mouth. BURNS says that "these and, indeed, all tonsillitic concretions have been distinguished by a fetid stercoraceous odour. Sometimes the concretion does not acquire the same degree of solidity as in the cases mentioned. In some patients it forms in the cryptæ of the tonsil, enlarging them, and even projecting into the fauces. Where it assumes that form, it can, by any blunt instrument, be turned out from the recesses of the tonsil in gritty masses of a dirty-white colour. The formation of this gritty matter would seem to be connected with some deranged state of the intestinal canal. It will be necessary to pick the foreign substance from the tonsil, and, to prevent its reproduction, the bowels must be restored to their natural action. It is by no means an uncommon affection." (pp. 263–5.)]

133. If the swelling of the hardened tonsils be so great that breathing and swallowing become very difficult, their partial extirpation is necessary. If the swelling be not very great, two or three transverse, but not very deep, incisions are sufficient to produce their diminution in the course of a few days. The removal is best effected by a narrow, slightly curved, blunt-pointed or button-ended bistoury, or with a narrow, straight, button-ended scalpel. The patient should be placed on a seat opposite the light, his head resting on the bosom of one assistant and a little inclined forwards, and his mouth kept open by a piece of cork placed between the hind molar teeth; whilst another assistant keeps down the tongue with a spatula. The operator fixes a double hook, or MUSEUX's hook forceps, which are preferable, in the swollen tonsil, holds the forceps with one hand and manages the knife with the other, so as to divide as much as is necessary of the tonsil at one stroke from beneath upwards. (The hook or forceps are to be used with the left, and the knife with the right, hand, if the left tonsil is to be removed; but the contrary, if the right.) If the tonsil still remain partially attached, it must be cut off by a second stroke of the knife or with COOPER's scissors.

In unsteady patients DESSAULT's *kiotome* is often preferable, which, when the patient is seated as above, the mouth open, and the hook, fixed in the tonsil, is so introduced with its edge retracted, that the tonsil comes against the slit part of the sheath, and the projecting part is cut off by the protrusion of the knife. The introduction of the hook often produces severe tickling in the throat, suffocation, and so on, in order to avoid which the division may be made without previous introduction of the hook. If, on account of its size, the whole tonsil cannot be received into the curve of the kiotome, a part of it must be removed by two oblique cuts meeting at an angle; or cross cuts are to be made with the kiotome, first at the upper part, and next at the lower third of the tonsil; the isolated part is then to be taken into the curve of the instrument, and the two transverse connected by a third longitudinal incision. The deep cleft thus formed falls together in the course of five or six days (*a*). FAHNESTOCK's *tonsillitome* (*b*), with the alterations of VELPEAU and RICORD, is preferable to DESSAULT's kiotome. This instrument closed, that is, with the annular blades covering each other, and with the piercer retracted, is placed over the tonsil, which, projecting through the opening, is to be thrust through with the piercer; the movable stem is then pushed forward upon the immovable one, and the latter, at the same time, drawn back, so that the tonsil is taken off by the rings, of which the inner margins have each a cutting edge. Tying the tonsils is not to be preferred'

(*a*) ITARD, Traité des Maladies de l'Oreille et de l'Audition, Paris, 1821, vol. ii. p. 174.

(*b*) FRORIEP's Chirurg. Kupfertafeln, pl. 447.

to their removal by the knife; but their destruction by caustic is to be rejected. Only in not very great swelling of the tonsils, can their diminution be effected by the repeated application of lunar caustic sufficiently to produce a superficial slough.

The removal of the hardened tonsils has been performed from the earliest time by *cutting*, by *tearing out*, by *tying*, and by *destroying with caustic*. Celsus advised taking hold of the tonsil with a hook and cutting off the hardened part with a knife. In this manner the operation has been performed with little variation. According to Louis, the cut should be made from below upwards; according to Richter, from above downwards, and the imperfectly divided piece is to be removed with scissors; according to Moscati, the cuts are to be made in various ways, by splitting the tonsil from above downwards and sideways, by introducing charpie, by removing it piece-meal, and by cauterizing the surface of the wound with nitrate of silver.

For holding the tonsil, a single or double hook is employed, Caque's hook (*a*), Muzeux's hook forceps (*b*), Wasserfuhr's forceps with thick blunt hooks, so that it may be more easily removed in case of vomiting. For the cutting, a narrow, button-ended, curved or straight scalpel, special knives of Paulus Æginetа, of Caque, of Ben. Bell, of Boyer, Dessault's kiotome; the scissors of Solingen, Percy, Levret; the instrument of Rivieri (*c*) and of J. Cloquet (*d*), with two branches, which cross, and each of which has an edge at its extremity.

Tearing out the tonsils was performed by Celsus with the fingers; by Fabricius ab Aquapendente with the hook or forceps.

Tying the tonsils, mentioned so early as by Guillemeau (*e*), was performed by Sharp (*f*) with silver wire or catgut; by Cheselden (*g*) the loop was applied with the finger and fastened with an eyed probe; swellings with a broader base were tied on the side with a double thread introduced by a needle having an eye near the point; by Bibrach (*h*) with a silver wire by means of Levret's double cylinder; by Siebold (*i*) with a loop pushed on upon a pair of forceps, the ligature having been slipped on to them by an assistant; Bell introduced through the nose a loop which by means of the finger was carried over the tonsil and tied with a polypus-cylinder introduced through the nose; by Chevalier (*k*), a double thread was drawn through the base of the tonsil, after Cheselden's method and tied with a ring-shaped knot closer. Hard also invented a tying instrument (*l*) for the same purpose.

Cauterization of the tonsil with red hot iron or with caustic, after the manner of Severinus and Wieseman.

[Else objected to the excision of the tonsils, especially in children, on account of the troublesome and dangerous hæmorrhage; neither was he favourable to tearing them away with the forceps, nor to destroying them with caustic, but preferred Cheselden's apparatus, consisting of a tonsil probe, needle, iron, and *speculum oris*, or a piece of cork. If the base of the swelling be narrow, a thread can be readily carried round with the probe; but if it be broad, it will be requisite to thrust the needle, armed with a double thread, one white and the other black to prevent confusion, through the base from without inwards, and, when the eye of the needle appears behind the tonsil, the threads are to be taken hold of, the needle withdrawn, and the corresponding threads tied.

The instrument for amputating the tonsils, invented by Physick of Philadelphia (*m*), consists of an oval iron loop, of two plates, rather larger than the ordinary size of the tonsils, and attached to a long stem, upon which rests a sliding rod, terminating in a knife of hexagonal form. The tonsil is received within the ring, and the knife being then thrust forward, cuts it off as it traverses the loop. He also uses a pair of forceps, with lunated extremities, and their opposing faces toothed, to draw the tonsil more firmly through the loop. I do not know whether this is Physick's guillotine instrument, which has been further improved by Mitchell, as I have not seen either. Within the last eighteen months, Simpson, instrument maker, of Westminster, has adapted Thorbern's staphylotome (which he has much simplified) to amputation of the tonsil, by giving the sliding knife an oblique cutting edge, like the guillotine knife, and the tonsil, being drawn

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(*a*) Mémoires de l'Académie de Chirurgie, vol. v. pl. xii. fig. 1.

(*b*) Ib., fig. 3.

(*c*) Comment. Bonon., vol. vii. 1791.

(*d*) Archives Générales de Médecine, May 1833, p. 124.

(*e*) Chirurgie, ch. vi.

(*f*) Critical Inquiry, sec. vii. ch. vi.

(*g*) Sharp's Treatise on Operations, plate xii. A. B. C.

(*h*) Mémoires de l'Acad. de Chir., vol. v. p. 480,

(*i*) Chirurg. Tagebuch, p. 163.

(*k*) As above.

(*l*) Froriep's Chirurg. Kupfertaf.

(*m*) American Jour. of Medical Sciences, 1827-8, vol. i. p. 262.

through the aperture with a double hook, is readily cut off. Each side of the throat requires its own instrument, on account of the obliquity of the knife-edge.

In the United States some surgeons prefer scissors to the knife, and others the guillotine instrument of **Physick**, with or without modification. The best scissors are those of Dr. **Smith** of Baltimore, the blades of which are curved on the flat, and bent like a hawk-bill towards each other, so that the points cross when the instrument is shut. Two small steel points are, in addition, attached to the side of each blade, so as to catch the portion excised, and prevent its falling into the glottis (*a*).

Gibson of Philadelphia (*b*), with the view of getting rid of the numerous instruments formerly used for the removal of enlarged tonsil, has invented an instrument which at once keeps down the tongue, holds the gland firmly, and separates it nearly at the same moment. "It consists of a pair of forceps nine inches long, the eighth of an inch thick, half an inch broad when shut, with extremities an inch and a-half long, slightly serrated and somewhat curved, including, when closed, an oval space a quarter of an inch wide, and terminating, at the other extremity, in handles which stand off obliquely from the shafts of the instrument. A knife or blade, the length and breadth of the forceps, rounded on its cutting edge, and having a button placed perpendicularly to its axis on the opposite extremity, works backwards and forwards, by means of a groove, to the extent of an inch and upwards, between the blades of the forceps, to one of which it is secured by screws. A sheath upon each end of the forceps, to keep the knife from starting off the moment it touches the tumour, completes the instrument." (p. 27.) "It is to be passed into the mouth with the blades closed, and resting flat on the tongue, which it presses. The instrument is turned edgewise, still resting on the tongue, its blades expanded, placed fairly around and completely behind the tumour, which is then seized and firmly held, while the thumb, resting on the button-like extremity of the knife, pushes it forwards, and instantly separates the enlarged tonsil, which is immediately brought away in the grasp of the forceps." (p. 27.)

The ordinary practice now is to remove the tonsil by cutting through with a knife, of which the blade is guarded to within an inch of its tip, the gland being drawn inwards towards the mesial line with a tenaculum or double hook. There is soreness for a few days, but granulations soon form, and the wounded part heals.—J. F. S.]

134. The bleeding after this operation is usually stopped by frequent gargling with cold water and vinegar; or charpie dipped in some astringent wash is applied with dressing-forceps to the bleeding part. In cases of necessity the red hot iron must be applied. During the inflammatory and suppurative periods, soothing and subsequently astringent gargles, with borax and so on, should be applied to the cut surface. If the suppurating surface assumes a luxuriant appearance, stronger astringents, even lunar caustic and the hot iron, must be used.

[Of wound of the carotid artery in removing the tonsil gland, I have not met with, nor heard of, a single instance.

Lawrence writes:—"I have removed enlarged tonsils very frequently, the loss of blood, in the majority of cases, not exceeding a tea-spoonful. It would, I believe, always be so, if the parts are in a perfectly quiet state. I once performed the excision in a gentleman from the country, who was obliged to leave London immediately, where there was a state of active congestion in the fauces; the bleeding was considerable, but not alarming."

But their removal is sometimes attended with very fearful hæmorrhage. My friend **Callaway** informs me, that he has "seen sometimes considerable, and, in one case where he had removed the tonsil by the knife, alarming hæmorrhage in a boy of seven years of age, which required stimuli, &c., to recover him from the fainting which followed." I have to thank my friend **Shaw** for the following

Case—A man aged forty years was deaf in the left ear, and the tonsil on that side being enlarged, it was excised with the guillotine on *Saturday*. No bleeding of consequence followed, the gland being hard and light-coloured, as if of old standing. On *Monday* he complained of sore throat, and the incised surface appeared as if a superficial slough were about to form. On the afternoon of *Tuesday* bleeding commenced in the lower part of the cut surface where ulceration had taken place adjoining the slough. An oozing of blood, varying in quantity, continued, in spite of repeated attempts to check it with styptics, till the afternoon of *Thursday*, when he was so much exhausted that the

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(*a*) See **Pancoast's** Treatise of Operative Surgery. (*b*) Institutes and Practice of Surgery, vol. ii.

carotid artery was tied. The bleeding now ceased completely; the wound rapidly closed, and the ligature came away on the twelfth day; in a short time after which he was discharged cured.

This case seems to bear a close resemblance to that of LAWRENCE'S; and both may, perhaps, be explained, on the presumption that the small vessels of the enlarged tonsil gland were unable either to contract or retract, in consequence of the adhesive matter with which the cellular tissue of the gland was filled, and by which its enlargement was caused, preventing their closure.—J. F. S.]

135. The *Uvula* is frequently so relaxed and lengthened by long-continued and repeated inflammation, that great inclination to cough and vomit, and difficulty in swallowing, is produced. In less degrees of swelling strongly astringent gargles of decoction of oak bark with alum, tincture of catechu, touching with acid, stimulating substances, with lunar caustic (1) and so on, are serviceable. In greater swelling, if these means fail, the removal of the *uvula* is called for. The patient being placed in the same position as for the removal of the tonsils, the *uvula* is to be taken hold of with a pointed hook, and the superfluous part cut off with scissors or with the kiotome. The after-treatment is similar to that for removal of the tonsils.

(1) BENNATI (*a*) recommends cauterization with nitrate of silver by means of a double caustic-holder.

The simple operation of removing the uvula was performed before the time of HIPPOCRATES by cutting, and in this way it has been mentioned by CELSUS, GALEN, ORIBASIUS, AETIUS, and PAULUS ÆGINETA, by means of the already-mentioned various instruments used for removal of the tonsils, to which must be added the *staphylagra* of PAULUS ÆGINETA, to hold, and the *staphylotome* to cut with; THORBERN'S (of Norway) instrument (*b*), with the alterations by RAU (*c*), by BASS (*d*), by FRITZE (*e*). The cauterization first mentioned by DEMOSTHENES of Massilia was performed by PAULUS ÆGINETA with the aid of a *staphylokauston,* and, by the Arabians, partly by caustic and partly by red hot iron; PARÉ used the ligature and the two FABRICII employed, by turns, scissors, caustic and ligature.

[Relaxation and elongation of the uvula is a most troublesome complaint. ASTLEY COOPER, who never removed more of the uvula than would reduce it to its proper proportions, as, if the whole were cut-off, fluids could not be taken without their passing into the nostrils, and without interference with articulation being produced, did not, however, consider any benefit was derivable from the operation, as the uvula almost invariably again acquired its natural length. Neither can I advise it, because from personal experience I know it to be unnecessary. It is commonly sympathetic with irritation of the alimentary canal, and when that is quieted, the uvula resumes its ordinary length. It often becomes very red, lengthens and swells in the course of an hour, and, by its constantly dropping on the epiglottis, irritates it, and excites a constant hacking cough, and frequently a sense of choking; the best immediate remedy for which is closing the mouth, and breathing through the nostrils. I have tried all sorts of astringent gargles, but found little relief from them; and have only been benefited by painting with a strong solution of nitrate of silver twice or thrice a-day, according to the irritation produced.—J. F. S.]

II.—OF INFLAMMATION OF THE PAROTID GLAND.

LAGHI, T., Historia Epidemicæ constitutonis, in quâ Parotides seroso glutine tumentes redduntur, quæ anno 1753 Bononiæ contigit; in Comment. Bonon., vol. v. p. 1.

HAMILTON, R., Account of a Distemper, by the common people in England vulgarly called the *Mumps;* in Trans. of Roy. Soc. of Edinburgh, vol. ii. p. 59. 1790.

HOPFF, Diss. de Anginâ Parotideâ. Goetting, 1799.

(*a*) Bulletin des Sciences Médicales, 1831, Août, p. 215.

(*b*) THOS. BARTHOLIN., Obs. Anatom., cent. ii. obs. 88. SCULTETUS Armament, pl. ix. fig. 1.

(*c*) HEISTER, pl. xxi. fig. 8.

(*d*) NUCK, p. 141.

(*e*) Med. Annal., vol. i. Leipsic, 1781.

Brennecke, Diss. Anginæ Parotideæ Descriptio pathologico-therapeutica. Helmst, 1801.

Burns, Allan, Observations on the Surgical Anatomy of the Head and Neck. Edinburgh, 1811. 8vo.

Good, Mason, M.D., Study of Medicine. London. Second Edition, 1825. Vol. II.

136. *Inflammation of the Parotid Gland* (*Inflammatio parotidis*) has a different course, according as it is connected with catarrhal fever, or is a *symptomatic*, *critical*, or *idiopathic disease.*

137. The *Mumps*, in Scotland the *Branks*, (*Angina* seu *Cynanche parotidea*, Lat.; *Bauernwetzel*, Germ.; *Oreillons*, ou *Ourles*, Fr.,) consists in a sometimes cold and rather œdematous, at other times hot, tense, painful flat or raised swelling of the parotid and submaxillary glands, with which also the tonsils are sometimes swollen, and swallowing and opening of the mouth prevented. The skin generally preserves its natural colour, or has an inflammatory blush. The swelling is frequently unaccompanied with fever, soon disperses, and does not easily run into suppuration; catarrhal symptoms, chilliness, rigors, and depression commonly precede, and it is mostly connected with fever similar to catarrhal, and frequently with active fever. In these cases a metastasis of the fever easily occurs. As the swelling of the parotid gland subsides, a fresh attack of fever with severe shivering, with pain in the loins and pubes, takes place, followed by inflammatory swelling of the testicle, and, in women, of the labia and breasts. Itching and burning in the generative organs, and frequently untimely menstruation, follow. The swelling of the parotid gland often still continues; but sometimes the inflammation, though it may have subsided, returns to the gland. Other parts are also frequently attacked; drowsiness, severe headache, wanderings, inflammatory or spasmodic affections of the breast, active vomiting, dropsical swelling of the whole body with short breathing and high fever occur.

In trifling cases the inflammation often subsides in a few days, sometimes later, with perspiration spreading over the whole tumour or over the whole surface of the body, with critical flow of urine and bleeding from the nose. The passage of this inflammation into suppuration or hardening is very rare. In some cases wasting of the testicle has been observed.

[Dr. Mason Good (*a*) speaks of two kinds of inflammation of the parotid gland; the one just mentioned, and another, which he calls *Parotid Phlegmon,* but both exhibiting two species or varieties, a simple or benignant, and a malignant form.

The first kind, his parotid phlegmon, Good briefly characterizes as "a tumour situated under the ear, reddish, hard; pain obtuse, suppuration slow and difficult," (p. 326,) and is "troublesome, and sometimes fatal." (p. 408.) Of its *benignant* variety he says:—"Though the suppurative process is slow and inactive, the incarnation subsequent upon the breaking of the abscess is regular and unobstructed." He mentions a case of this kind, in which a girl of fifteen years had, after the duration of the disease for ten weeks, "for about a fortnight an evident pointing towards the surface, and a feel of irregular fluctuation; it afterwards broke, a large quantity of good pus drained away daily, and the tumour, which at first was extensive and hard, by degrees very considerably diminished, and clustered or divided into lobes, and at length disappeared altogether." * * * "The abscess, in some cases of this variety, is of considerable magnitude, and consequently the discharge of pus very large." He says, that, sometimes, "the pus has been absorbed, and carried off by metastasis to some remote organ," of which he cites examples. (pp. 327, 8.) The *malignant* variety, Good says, "seldom appears in early life, and, in females, seems sometimes to follow upon the cessation of the catamenia. It is still slower in its progress than the preceding; and, when at length it breaks, the pus is

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(*a*) Above quoted.

imperfect, and cheesy or scrous. It is also profuse, and protracted to a long period, and accompanied with fatal sloughs. The patient is debilitated by the discharge, the irritation excites hectic fever, and the case frequently terminates fatally." (p. 328.)

The second kind, or *Mumps*, of which Chelius has just treated, Good observes, "is altogether of a different kind" from his first kind; "is more extensive, more painful, and rarely tends to suppuration." This kind, he proceeds to say, "in advanced life, is sometimes apt to run into a chronic form, accompanied with very mischievous symptoms; in which state it is denominated a malignant parotid. This is more especially apt to take place in females, when menstruation is on the point of ceasing, and the general action of the system labours under some disturbance." (p. 409.)]

138. This disease prevails mostly as an epidemic, more frequently in southern than in northern regions, in very changeable, especially moist and wet weather, and in spring time. Some consider it contagious; it, however, attacks only once during life; it seizes on all ages and both sexes, young people especially, and particularly young males. The severity of this disease differs materially in different epidemics.

139. Inflammation of the parotid glands not unfrequently occurs in typhus fever, sometimes with, sometimes without, benefit. Scrofula, syphilis, repulsed eruptions, often giving origin to it, or it is caused by improper use of mercury, carious teeth, difficult dentition, by cold, or by external injury. The character and course of the inflammation differs in these cases. It may be so severe as to run into mortification, but generally has a milder result, and passes into *suppuration* (1), *hardening* (2), and *sarcomatous hardening* of the parotid.

[(1) Evanson and Maunsell (*a*) say, that the swelling of mumps "at times, but very rarely, will proceed to suppuration, and may cause immediate death, by discharging its contents into the larynx, if it burst internally, or lead to great deformity when it opens externally." (p. 216.)]

(2) Mason Good says, his parotid phlegmon "assumes, occasionally, a scirrhous hardness, and grows to a considerable extent; it has been extirpated, but with variable success, when upwards of three pounds in weight (*b*); sometimes with a cure (*c*); but, at other times, it has degenerated into a foul bleeding and extensive ulcer" (*d*). (p. 328.)

140. If the inflammation be mild, the preservation of warmth in the swelling by covering it with flannel, or bags of elder flower and so on, and the use of gentle diaphoretics, are sufficient. If the condition be decidedly inflammatory and the fever severe, antiphlogistic means, and even bloodletting must be employed; moderately, however, and with great caution. But, if the patient be very weakly, and the fever incline rather to the nervous type, mild infusions of balm, valerian, with solution of acetate of ammonia, camphor, and so on, must be given. When the swelling has not properly risen, when it has subsided, or when the perspiration upon it ceases, a blister may be applied. When the inflammation attacks the generative organs they must be kept warm, covered with flannel, and the testicles supported by a suspensory bandage. If the brain be attacked, blisters must be laid upon the scrotum and on the parotid glands and *liquor ammon. acet.* with warm drinks administered internally, and, in depressed vital powers, camphor, antimonial wine and the like. The vomiting originating in nervous irritation must be treated by suitable remedies both external and internal. If the swelling continue long and do not disperse, a volatile liniment with camphor is to be rubbed in.

141. If the inflammation of the parotid gland be connected with dyscratic

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(*a*) Above quoted.

(*b*) Kalthchmied, Pr. de Tumore Scirrhoso trium cum quadrante librarum Glandulæ Parotidis extirpato. Jenæ, 1752.

(*c*) Siebold, Parotidis scirrhosæ feliciter extirpatæ Historia. Erf., 1791.

(*d*) Commerc. Lit. Nor., 1733–8.

state of the body, a corresponding general treatment must be had recourse to; according to the variety of the symptoms, leeches, mercurial friction, dispersing plasters, herb bags, and derivative remedies are to be used locally.

If the inflammation be critical, every thing must be withheld which may produce its revulsion. If the swelling be accompanied with a proper degree of inflammation, it must be simply covered with a mild poultice; if the living activity in it be too low, stimulating poultices and plasters must be applied.

142. When suppuration has taken place the abscess either breaks of itself under the use of the remedies mentioned in the treatment of abscesses, in which case the cure commonly soon follows; or the formation of abscesses is accompanied with severe symptoms, delirium, lock-jaw, and so on, under which circumstances the swelling is to be soon and sufficiently opened, so that the tension of the aponeurotic sheath of the gland may be relieved. According to its condition, the abscess must be treated with soothing or stimulating remedies. The treatment is always tedious; knotty scars and detached hardnesses readily form. If a fistulous aperture remain, through which the spittle flows, it must be treated by touching with lunar caustic, which, aided by proper compression, will close it (*a*). If the gland become hard, it must be treated after the ordinary rules.

III.—OF INFLAMMATION OF THE BREAST.

Schlegel, F. A., De Statu sano et morboso Mammarum in Gravidis et Puerperis. Jenæ, 1792.

Müller, fragmentarische Bemerkungen über die Entstehung und Heilung der Entzündung und Vereiterung der Brüste bei saügenden Weibern; in von Siebold's Chiron., vol. ii. p. 2, *par.* 344.

Boer's natürliche Geburtshülfe und Behandlung der Schwangern, Wöchnerinnen und neugebornen Kinder, Wien, 1817, vol. iii. p. 23.

Benedict, T. W., Bemerkungen über die Krankheiten der Brust und Achseldrüsen. Breslau, 1825. 4to. I. IV.

Cooper, A. P., Illustrations of Diseases of the Breast. London, 1829. 4to.

Jeanselme, G., Mémoire sur les Inflammations et les Abcès du Sein chez la Femme; in Gazette Médicale. January, 1839.

143. *Inflammation of the Breast* (*Inflammatio Mammarum*) occurs in women either nursing or after that period; and is situated either in the *skin and cellular tissue* alone, or *in the parenchyma of the gland itself.*

144. If the inflammation occur during suckling, the breast on a sudden becomes tense, red, and swollen. If the inflammation be *superficial*, a regular smooth and shining swelling may be felt, but the secretion of milk does not always cease. In inflammation of the *parenchyma of the gland* the swelling is harder, different knobby swellings are felt, and the secretion of milk is completely stopped. It is not unfrequently accompanied with febrile symptoms.

145. The superficial inflammation of the breast generally subsides of itself; but, if the parenchyma be attacked, the inflammation at a certain stage proceeds to suppuration, and not unfrequently hardening remains.

146. The usual causes of this inflammation are cold, mental excitement,

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(*a*) For the further consideration of the treatment of fistulous opening in the parotid duct, see Salivary Fistula, *par.* 902.

mechanical injury and so on. Women who do not suckle, or who wean their children early, are specially subject to inflammation of the breast. In order to prevent it, they must use a strict diet, encourage perspiration, take purgatives; apply cotton fumigated with sugar to the breasts, rub the nipples often with spittle, and support the breasts.

[Too many women, to their great shame, refuse suckling their children, on account of the restraint which this, one of their most important duties, puts upon them; some, unfortunately, early loose the progeny they would sacrifice themselves to bring up; and others, either from ill-health or from soreness of the nipples, are incapable of giving suck. In all these cases the secretion of milk must be checked, and the milk already secreted induced to absorb. Spare diet and purging, as recommended by **Chelius**, will usually effect the first object. As to the second, an evaporating lotion of spirit of wine or Cologne water, kept constantly on the breasts, which are to be carefully supported, and, therefore, the recumbent position and undress are the best for the purpose. The ordinary practice of monthly nurses is continued and gentle friction of the breasts with oil and brandy performed three or four times a-day.—J. F. S.]

147. The same remedies must also be employed at the commencement of inflammation. And not until it becomes more active, and the swelling tense and hard, must warm softening poultices and soothing steam be applied to the breast, and emollient ointment rubbed in. If the inflammation disperse, the tension and swelling gradually subside; isolated hardenings slowly disappear under the use of softening poultices and mercurial salve. If the inflammation take place whilst the child is still suckling, it may be freely put to the breast, so long as the swelling and pain are not great. If with a free flow of milk the child cannot draw off sufficient, it must be withdrawn by a milk-glass in the intervals. If the inflammation become very severe, all attempts to remove the milk from the breast are injurious.

148. If the inflammation pass into suppuration, the softening poultices must be continued, cicuta or mercurial plaster applied, and the opening of the abscess left to nature. In general many openings take place at different parts, and they are to be treated in the usual way till they close.

If during suppuration fistulous openings are formed and the breast remain very hard, (which is commonly the case when the abscess is opened artificially, or lumps of charpie are introduced into the openings,) the before-mentioned mode of treatment can alone effect the resolution of the hardening and the closure of the openings.

After much experience, I cannot but reject the opening of abscesses of the breast recommended by many. There are, however, exceptions; when the abscess is very deep, when it has proceeded slowly, when the local pain is very great and the fever high, and profuse perspiration and continued restlessness are present. After the artificial opening, poultices must be always applied as above mentioned. In lengthy fistulous passages in the breast gland, **Langenbeck** recommends the introduction of ligatures. I have, in such cases, even when the fistulous passages have been accompanied with much surrounding hardness, always attained my purpose with the treatment above stated. If milk escape from these passages, its secretion must be lessened by the use of purgative remedies, together with a sparing diet; or, in weakly constitutions, by the use of bark and strengthening food. Nothing is more objectionable than the introduction of tents into fistulous passages of the breast gland, or, as has been very recently, advised, the putting in little tubes to keep up the flow of pus. The irritation is always thereby much increased and hardening of the whole neighbourhood originated.

[**Chelius**'s recommendation of leaving "the opening of the abscess to nature" must on no account be followed, as its certain result is, according to his own observation, the occurrence of "many openings at different parts" of the breast, and the necessary production of very unsightly scars, which most grievously annoy the patient and her friends, and deservedly discredit the reputation of the medical attendant. The abscess is *always to be punctured freely, so soon as fluctuation can be distinctly felt,* and whilst the walls of the abscess are still thick. The almost immediate ease gained by relieving the tension of the fibrous covering of the breast gland is the first advantage obtained; the burrowing of pus is also prevented, and thereby a smaller cavity left, when emptied, to fall together and fill up by granulation; and, most important of all, the sloughing of the skin almost to a certainty precluded. No squeezing or kneading of the breast to evacuate the pus, as often most improperly practised, is to be on any account resorted to, the agony thereby produced is extreme, the benefit gained nothing, for the aperture made should be sufficiently large to permit the free escape of the matter, which, having been allowed to flow as long as it will, a strip of lint, oiled, is to be introduced between the lips of the wound to prevent their union, and a light bread poultice, or warm fomenting flannels laid over the breast and repeatedly renewed. In the course of a few hours the lint should be withdrawn, and the wound generally remains sufficiently open to permit the continual flow of the pus. If, as not unfrequently happens, clots of adhesive matter, or dead cellular tissue, block up the opening so that the matter does not readily escape, they may be gently removed if they protrude between the lips of the wound. But, if not, and the pus be still retained, a grooved director should be very gently introduced into the cavity of the abscess, and by its canal the discharge will pass; but no pressure is on any account to be used. If a second, or even a third, abscess point, or if the same abscess point at a different part of the breast, these are severally to be opened as they occur, the prime object of the treatment being to remove every chance of sloughing and scar of the skin. Oftentimes the first discharge is extremely fetid, more particularly if the opening of the abscess have been delayed, or if it have been left to burst spontaneously, and in these cases the constitutional excitement is frequently very great, amounting even to delirium. The character of the suppuration, however, usually soon becomes healthy, and the febrile symptoms speedily subside. CHELIUS's objections to passing tents or tubes into the fistulous passages, which generally alone occur from leaving the abscess to burst of itself, are well founded; they never ought to be employed. Neither should LANGENBECK's plan of introducing ligatures be for a moment thought of; it is very bad practice.

Fistulous passages almost invariably occur from the pus not having a convenient and complete discharge. Sometimes gentle, well-applied pressure along the course of the sinuous passage may be sufficient to produce inflammation and adhesion of its walls; but, if not, or if the patient cannot, as sometimes happens, bear the necessary pressure, then a probe should be introduced, and its extremity cut down upon through the skin at that part of the sinus which is most depending. Usually in a few days the old aperture heals, the pus is discharged by the new wound, and soon a cure is effected. As a general rule, injections of these adventitious canals is not advisable; but, when the opening is at the most depending part, and they can be employed simply to wash out the canal and slightly irritate it, but without being retained, which will often create more inconvience than that to be got rid of, then they may be used with discretion. A mild solution of sulphate of zinc is, I believe, the best injection.—J. F. S.]

149. After previous inflammation there frequently remain the so-called *Milk-knots*, (*Milchknoten*, Germ., *Ganglions laiteux*, Fr.); or they appear at a shorter or longer period after the suppression of the secretion of the milk, or after weaning the child, in cases where the secretion of milk seemed to have entirely ceased. Their hardness varies, and is often cartilaginoid, though only containing milk; they may remain for a long while, and on superficial examination are easily mistaken for scirrhus. Their termination is in *resolution*, which is still possible after a long while, or in *suppuration* if they accidentally inflame. The remedies which effect their dispersion are, gentle rubbing of the breast towards the nipple, sucking the nipple, softening poultices, especially oatmeal, linseed meal, cicuta, hyoscyamus, saffron and oil, rubbing in lard and hartshorn. Some recommend belladonna internally. The dispersion is always accompanied with a flow of milk from the breast. Milk-knots which have not yielded to any remedies often subside at the next lying-in.

150. Inflammation of the breast, apart from suckling-time, has generally an insidious course. The pain in the neighbourhood is very slight; but the swelling of the breast is always very hard, and the inflammation has a marked disposition to hardening. Its causes are external injury, dyscracy,

scrofula, gout, syphilis, and so on. In many cases the inflammation sets in without any manifest cause, and the ground of the irritation may be merely the sympathetic relation of the breast to the womb, which discovers itself especially at the period of decrepitude, and in unfruitful women, in whom the functions of the womb have never gone on regularly.

151. The treatment of such inflammation must be guided by the previous mischief. Repeated application of leeches, infriction of mercurial ointment, warm covering of the breast, and internal remedies suited to the general dyscracy, are here required, although they can rarely prevent the production of hardening. When this takes place, it must be treated after the general rules.

152. In rare cases, either during suckling or not, deep-seated abscesses form in the breast gland or between it and the pectoral muscles, the formation of which is connected with a deep-seated pain, at first shifting, burning, tearing, with a considerable colourless swelling of the whole breast, and pain on moving the arm, and it continues for a long time before any external fluctuation can be perceived. The pus frequently makes its way out at several points, and the breast gland is hard and swollen. If these suppurating passages be opened, they present a soft reddish fungus. When fluctuation in such abscesses can be ascertained, they must be opened early. If fistulous passages have formed, they must be laid open throughout their whole length, or, in order to prevent deformity of the breast, and interference with its function, (according to **Langenbeck**, the ligature should be introduced,) softening poultices and rubbing with mercurial ointment should be employed. If a part of the breast be so distended by these passages that, after opening them, it seems to hang as it were by a neck, it should be entirely removed; the cure soon follows. The passage to suppuration may perhaps be prevented by the early employment of diaphoretics, by emetics, by dry warmth, and by the application of derivative blisters in the very neighbourhood of the breast.

Hey, William, Surgical Observations.

Richter's, Medicinische und chirurgische Bemerkungen, vol. i. p. 50.

Langenbeck, Nosologie und Therapie der chirurgischen Krankheiten, vol. ii. p. 264.

[In the description which **Astley Cooper** gives of chronic abscess of the breast, it will be seen that he had not noticed the severe pain to which **Chelius** alludes. "Under chronic inflammation," says **Cooper**, "an abscess is sometimes produced, which, from the length of time it is forming, from the little pain which attends it, from the absence of redness and heat in the part, and from the want of rigors and other constitutional symptoms, prevents the suspicion of the formation of matter, and the swelling is supposed to be a malignant tumour, which requires an operation for its removal." (p. 14.)

I had once the ill luck of operating on such a case, of which the following is the account, and will be found to tally so nearly with the ordinary history and course of scirrhus that I may be held excused.

Case—E. S., aged forty-five years, a married woman, admitted,

July 23, 1835. About twelve months since received a blow on the right breast, and four months after, whilst suckling, received another, but she felt nothing more than a slight shooting, of which she took no heed till after weaning her child four months since. She had not suckled from this breast, as the last child would not take it; but the secretion continued, and the milk flowed out till she ceased to suckle. After weaning, the breast began to swell, and she first noticed the lump, for which she applied leeches and fomentations. These diminished the general swelling, but without dispersing the lump, which, on the contrary, continued increasing, accompanied with smarting pain, and at the time of her admission was about the size of a pigeon's egg, situated just below and to the outer side of the nipple, with the skin slightly adherent, very hard, and the nipple somewhat retracted.

July 31. The tumour was removed, and, on cutting into, was found to contain the cyst of an abscess about the size of a walnut, and containing pus. The surrounding parts were thick and hardened, but there was not any appearance of scirrhus. She did well.—J. F. S.]

153. Imperfections of the nipples, if they be too small, inflame, or are overspread with a pustular eruption, render suckling painful or impossible, and frequently give rise to inflammation of the breast gland. Small and deep-set nipples erect themselves best if during pregnancy a ring of horn or wood be worn, in the aperture of which the nipple may be placed. Inflammation of the nipple at first requires lotions of cold water with a little spirit or red wine. If they crack, Hufeland's ointment (*a*) is the best; but, according to my experience, it ought not to be employed without putting on nipple-shields directly afterwards, for the purpose of preventing the linen sticking. This disease may be often prevented, if, in the latter months of pregnancy, the nipples be frequently washed with red wine or with spirit and water. A pustular eruption drying into a scab often surrounds the nipple to a greater or less extent, and occurs mostly in persons who have formerly been subject to the itch or herpetic eruptions. Particular attention to cleanliness, and frequent rubbing in an ointment of hog's lard and flowers of sulphur, or, if little inflammation accompany it, frequent dabbing with solution of sublimate, is according to my experience always sufficient to prevent this eruption, and never have I been compelled to resort to a general plan of anti-herpetic treatment.

For this cracking of the nipples, accompanied with so much pain, Cooper recommends a solution of borax with a little spirits of wine; Hanney (*b*), touching with lunar caustic and wrapping in zinc ointment; from time to time, before putting the child to the breast, it is to be washed with a saturated solution of borax. Upon the application of the "cosmétique infaillible et prompt contre les gerçures au sein, composé par Liebert," *see* Volz (*c*).

IV.—OF INFLAMMATION OF THE URETHRA.

Allen, J., de Fluoris Albi charactere ac notis, quibus cum Gonorrhœâ convenit vel differt, et utriusque curatione. Lugd. Bat., 1751. 8vo.

Murray, J. A., de Materiâ Arthriticâ ad verendâ aberrante; in J. P. Franck. Delect. Opusc. Medic., p. 5.

Baldinger, E. G., Programma, quo Gonorrhœa ab amore meretricio virus venereum defenditur. Goetting., 1778. 8vo.

Hunter, John, A Treatise on the Venereal Disease. London, 1786. 4to. 3rd Edition. 4to. London, 1810. Edited by Everard Home.

Hecker's Ablandlung über den Tripper. Leipz., 1787. 8vo.

Tode, J. C., über die Erkentniss und Heilung des Trippers. Koppenh. und Leipz., 1790. 8vo.

Bell, Benjamin, A Treatise on Gonorrhœa Virulenta and Lues Venerea. 2 vols. Edinburgh, 1793. 8vo. 2nd Edition. 1797.

Ansiaux, J. C. M . P., Sur la Blennorrhagie. Paris, 1807. 4to.

Autenreith, De morbis quibusdam, qui Gonorrhœam malè tractatum sequuntur. Tubing., 1807. 4to.

Cullerier,—Article *Blennorrhagie;* in Dictionnaire des Sciences Médicales, vol. iii.

Cooper, Astley, Surgical Lectures; in Lancet. 1823–24, vol. ii.

(*a*) Journal der practischen Heilkunde, vol. xiv. p. 3.—R. gummi arab. ʒij; ol. amygdal. ʒjss; bals. Peruv. ʒj; aq. rosar. ℥j. Misceat. Fiat linimentum.

(*b*) Med. Gazette, Sept. 1834

(*c*) Heidelb. Med. Annalen, vol. iv. part ii. p. 517

Bacot, John, A Treatise on Syphilis, &c. London, 1829. 8vo.

Abernethy, John, Lectures on the Theory and Practice of Surgery. Lond., 1830 8vo.

Eisenmann, der Tripper in allen seinem Formen und in allen seinem Folgen, vol. ii. Erlangen, 1830. 8vo.

Wallace, William, A Treatise on the Venereal Disease and its Varieties. London, 1838. 8vo.

Ricord, Philippe, M.D., Traité Pratique des Maladies Vénériennes; ou, Recherches Critiques et Expérimentales sur l'Inoculation appliquée à l'étude de ces Maladies. Paris, 1838. 8vo. The same translated, as A Practical Treatise on Venereal Diseases; or, Critical and Experimental Researches on Inoculation applied to the study of these affections, &c., by H. P. **Drummond**, M.D. London, 1842. 8vo.—[N.B. The quotations are from this translation, but compared with the original.—J. F. S.]

Besides these, the works upon the Venereal Disease, referred to in Venereal Sores.

154. *Inflammation of the internal membrane of the Urethra*, vulgarly called *Clap*, (*Gonorrhœa*, *Blennorrhœa*, *Blennorrhagia Urethræ*, *Urethritis*, *Urethralgia*, Lat.; *Tripper*, Germ.; *Chaude-pisse*, Fr.,) is produced by any irritation of the urethra by a foreign body, by gouty, rheumatic, scrofulous acrimony, but most commonly by contagion in coition.

["The disease," says Swediaur (a), "is commonly called a *Clap*, from the old French word *clapiers*, which were public shops kept and inhabited by single prostitutes, and generally confined to a particular part of the town, as we see still to-day in several great towns in Italy."—(*note*, p. 22.) He disapproves of the term gonorrhœa, as conveying an incorrect notion, and proposes the use of *Blennorrhagia*, signifying a flow of mucus. Wallace objects to the employment of either designation, and proposes, in their stead, that of *Venereal* or *Syphilitic Catarrh*, which, however, is merely a trivial alteration of the modern French name, *Catarrhe Urethrale*.]

155. The symptoms and course of gonorrhœa vary considerably. In men, at a shorter or longer period, usually six, eight or ten days after an impure connexion (1), there arises a tickling sensation at the orifice of the urethra, which frequently spreads over the whole glans; the lips of the orifice are generally a little swollen and inflamed (2); and the discharge of urine is painful (3). After some time a discharge takes place, at first more serous, but afterwards thick, puriform and yellowish white. The pain is sometimes slight, sometimes severe, extends towards the root of the penis, which itself swells (4); the orifice of the urethra is much inflamed, excoriated, and its canal narrowed by swelling (5); the stream of urine is lessened, and frequently broken (6). Painful erections occur with bleeding from the urethra (7), and, if the spongy body itself be swollen, *painful curving of the penis* or *chordee*, (*chorda*, Lat.,) on account of its not yielding during the erection (8). The patient often feels a heaviness in the pelvis; the scrotum, testicles, and perinæum become very tender (9); the prostate and inguinal glands, painful and swollen. The surface of the glans itself often inflames, swells, and secretes a puriform discharge (*balanitis*.) The foreskin frequently inflames and becomes so swollen that it cannot be brought backwards over the glans (*phimosis*,) or, if this have been forcibly effected, it remains constricted, behind the glans (*paraphimosis*.) The puriform fluid discharged from the urethra is, in active inflammation, of small quantity, discoloured, greenish, even blackish (10), and is not unfrequently wholly suppressed, (*dry gonorrhœa*,) febrile symptoms, inflammation of the testicles, of the eyes, and swellings of the joints ensue. In very acute gonorrhœa the inflammation may be continued even to the bladder and produce dangerous retention of urine (11).

(a) Practical Observations on Venereal Complaints. Edinburgh, 1788. 8vo.

(1) **Hunter** says, on this point:—"In the gonorrhœa the times of appearance are very different; I have had reason to believe that in some the poison has taken effect in a *few hours*, while in others it has been *six weeks*;" however, "six, eight, ten, or twelve days would appear to be the most common period." (p. 32.) **Astley Cooper** says he has known gonorrhœa to "occur within twenty-four hours after connexion; and sometimes a fortnight, or a longer time will elapse before it appears. I have known an instance in which it was delayed *fourteen* weeks, in consequence, I believe, of the general indisposition of the patient." (p. 189.)

(2) "The first symptom which takes place," says **Astley Cooper**, "is a pouting state of the lips of the urethra, arising from inflammation." (p. 190.)

(3) **Hunter** observes, that "there is often no pain till some time after the appearance of the discharge, and other symptoms; and, in many gonorrhœas, there is hardly any pain at all, even when the discharge is very considerable. * * * There is generally, at this time, a greater fulness in the penis, and, more especially, in the glans, although it is not near so full as when erected, being rather in a state of half erection. Besides this fulness, the glans has a kind of transparency, especially near the beginning of the urethra, where the skin is distended, being smooth and red, resembling a ripe cherry: this is owing to the reticular membrane being loaded with a quantity of extravasated serum, and the vessels being filled with blood." (p. 46.)

Travers (*a*) says, that "heat in urining, titillation, tumefaction, which often precede the appearance of the discharge, even for days, may sometimes be removed by rest, purging, and mucilaginous drinks, so that the inflammation is subdued before it reaches purulent secretion. Coition in this state infallibly produces discharge; sometimes with a full, thick, high-coloured discharge, there is neither heat, swelling, nor colour of the *labia urethræ*. These symptoms, on the other hand, may be all considerable, with a thin and scanty discharge, and often without any heat. These differences are only to be explained by reference to the condition and susceptibility, local or general, of the person infected." (p. 7.)

(4) According to **Hunter**, "When the disease attacks the urethra, it seldom extends further than an inch and a-half, or two inches at most, within the orifice, which distance appears to be truly specific, and what I have called the *specific extent of the inflammation*. * * * When the gonorrhœa (exclusive of the affections arising from sympathy) is not more violent than I have described, it may be called *common* or *simple venereal gonorrhœa*; but, if the patient is very susceptible of such irritation, or of any other mode of action which may accompany the venereal, then the symptoms are, in proportion, more violent. In such circumstances, we sometimes find the irritation and inflammation exceed the specific distance, and extend through the whole of the urethra." (pp. 54, 5.)

As to the actual seat of the discharge in the male, **Hunter** says:—"As it would appear that there is hardly a sufficient surface of the urethra inflamed to give the quantity of matter that is often produced, especially when we consider that the inflammation in common goes no further than two or three inches from the external orifice, it is natural to suppose that the discharge is produced from other parts, the office of which is to form mucus for natural purposes, and which are, therefore, more capable of producing a great quantity upon slight irritations, which hardly rise to inflammation. These parts, I have observed, are the glands of the urethra. In many cases, where the glands have not been, after death, so much swelled as to be felt externally, and where I have had the opportunity of examining the urethra of those who have had this complaint upon them, I have always been able to discover that the ducts or lacunæ leading from them, were loaded with matter, and were more visible than in their natural state; I have observed, too, that the formation of the matter is not confined to these glands entirely, for the inner surface of the urethra is commonly in such a state as not to be able to suffer the urine to pass without giving considerable pain; and, therefore, most probably, this internal membrane is also affected in such a manner as to secrete a matter. This discharge, in common cases, would seem not to rise much further back in the urethra than where the pain is felt, although it is commonly believed that it comes from the whole of the canal, and even from **Cowper's** and the prostate glands, not excepting what are called the *vesiculæ seminales*." (pp. 50, 51.)

Astley Cooper asserts, that "the cause of gonorrhœa is undoubtedly inflammation of the *lacunæ* of the urethra, and particularly of the *lacuna magna*. The inflammation is of the erysipelatous kind; but there is no appearance of ulceration. If ulceration were produced, the membrane of the urethra would soon give way. It is merely a secretion from the mouths of the vessels; ulceration does take place in the lacunæ, but not in the urethra itself." [**Cooper** certainly does not here wish it inferred that this ulceration of

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(*a*) Observations on the Pathology of Venereal Affections. London, 1830. 8vo.

the lacunæ is more than accidental, or that it has anything to do with the gonorrhœa.—J. F. S.] From the opportunity which **Cooper** had of examining a person who had been executed whilst affected with gonorrhœa, he states, that "the inflammation had extended down to the bulb of the urethra; for an inch or an inch and a-half down, the urethra was exceedingly red, and there was some effusion of matter on the internal surface; the urethra was red at the bulb, but not of so deep a colour. The inflammation, therefore, is not confined to an inch or an inch and a half down the urethra, but often extends over the bulb, and in this way produces strictures." (p. 190.)

(5) Not unfrequently small swellings are noticed externally in the neighbourhood of the urethra, which, **Hunter** thinks, are enlargement of its glands; they sometimes suppurate and burst externally, but at other times internally. **Hunter** has well described them:—"At times swelling very considerably, even to the size of a small flattened nut, inflaming, and then a gush of matter flowing from the urethra, they almost immediately subside. The discharge has continued for some time gradually diminishing, till it has entirely gone off, and the tumour been almost wholly reduced; yet, some months after, it has swelled in the same manner again, and terminated in the same way." There can be no doubt of the correctness of his suspicions, that "these tumours are the ducts or lacunæ of the glands of the urethra, distended with their mucus, from the mouth of the duct being closed, in a manner similar to what happens to the duct leading from the lachrymal sac to the nose; and, in consequence of the distension of the ducts or lacunæ, inflammation and suppuration come on, and ulceration takes place, which opens a way into the urethra; but this opening soon closes up, and this occasions a return." (p. 48.)

(6) "The fear the patient is in," says **Hunter**, "when he is making water, assists in diminishing the stream of urine. The stream, as it flows from the urethra, is generally much scattered and broken the moment it leaves the passage, which is owing to the internal canal having become irregular, and *is not peculiar* to a venereal gonorrhœa, but common to every disease of the urethra that alters the exact and natural figure of the canal, even although the irregularity is very far back, as we find in many diseased and prostate glands." (p. 47.)

(7) "The bleeding," **Cooper** (*a*) observes, is "generally from that part of the urethra opposite to the *symphysis pubis*." They are generally serviceable; "but, when they produce fainting, and, as soon as the person recovers from that state the hæmorrhage recurs, and that for two or three times, it must be checked."

"When the inflammation is violent," **Hunter** observes, "it often happens that some vessels of the urethra burst, and a discharge of blood ensues, which is in greater quantity at the close of making water; this, however, takes place at other times, and generally gives temporary ease: sometimes this blood is in small quantity, and only gives the matter a tinge, as I observed when treating of the colour of the discharge. The erections of the penis often stretch the part so much, as to become a cause of extravasation of blood; this extravasation generally increases the soreness at the time of making water, and in such a state of parts, the urethra is usually sore when pressed; yet the bleeding diminishes the inflammation, and often gives ease." (p. 52.)

In rare cases, the *corpus spongiosum* bursts, and a little swelling, caused by the extravasated blood, is observed externally, which, however, is not of material consequence, and is gradually absorbed. But I may here mention, that I once saw a case, under my colleague **Mackmurdo**'s care, in which there was enormous extravasation of blood, from bursting of some vessel in the penis, during the act of coition; and the result of which was, the penis especially and the perinæum were greatly distended, and he was unable to pass his urine without extreme pain, in consequence of which a catheter was introduced. In the course of two or three days, extravasation of urine ensued, and the bladder was punctured through the rectum. Considerable sloughing, not only in the perinæum, but also up into the groins, took place, into which incisions were made, as needed, and he ultimately, though slowly, recovered.—J. F. S.

(8) **Hunter** divides chordee into inflammatory and spasmodic:—"When the inflammation is not confined merely to the surface of the urethra and its glands, but goes deeper, and affects the reticular membrane, it produces in it an extravasation of coagulable lymph, as in the adhesive inflammation, which, uniting the cells together, destroys the power of distension of the *corpus spongiosum urethræ*, and makes it unequal in this respect to the *corpora cavernosa penis*, and therefore a curvature on that side takes place in time of erection, which is called a chordee. * * * As it arises from a greater degree of inflammation than common, it is an effect which may, and often does, remain after all infection is gone, being merely a consequence of the adhesive inflammation. The spasmodic chordee arises from spasm, at least, it cannot proceed from the same cause

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(*a*) MS. Lectures on Surgery.

with the other, if my idea of that complaint be well founded. The spasmodic chordee comes and goes, but at no stated times; at one time there will be an erection entirely free from it, at another it will be severely felt; and this will often happen at short intervals." (pp. 52, 3.)

ABERNETHY (a) mentions "another, and more permanent, kind of chordee, which arises from inflammation having been propagated to the *corpus spongiosum;* coagulable lymph is thrown out, which glues the cellular tissue together, prevents that part of the *corpus spongiosum* being injected with blood during the erection of the penis, and occasions it to be crooked and bent towards the contracted side. This forms a true and permanent chordee."

HUNTER also speaks of "a soreness often felt by the patient all along the under side of the penis, owing to the inflamed state of the urethra. This soreness often extends as far as the anus, and gives great pain, principally in erection; yet it is different from a chordee, the penis remaining straight. With most gonorrhœas there is a frequency in the erections, arising from the irritation at the time, which often approach to a priapism, especially when there is the above-mentioned soreness, or when there is a chordee." (p. 48.)

(9) HUNTER says he has "seen cases where the irritation has extended so far as to affect with real pain the thighs, the buttocks, and the abdominal muscles; so that the patient has been obliged to lie quiet in a horizontal position; the pain has, at times, been so considerable as to make him cry out, and the parts have been very sore to the touch; they have even swelled, but the swelling has not been of the inflammatory kind; for, though there was a visible fulness, yet the parts were rather soft." (p. 54.)

(10) These changes in colour, HUNTER considers, "depend on the increase or decrease of the inflammation, and not on the poisonous quality of the matter itself; for any irritation on these parts, equal to that produced in a gonorrhœa, will produce the same appearances. * * * It is very probable that there is a small extravasation of red blood in all cases where the matter deviates from the common colour, and to this the different tinges seem to be owing. * * * It has often a smell seemingly peculiar to itself." (p. 56.)

(11) I have seen retention of urine from severe gonorrhœa, in which it was thought necessary to introduce a catheter; a practice, however, which I do not approve of, and I think might be evaded by warm baths, leeching, and purging.—J. F. S.

HUNTER, however, mentions the very contrary condition from the extension of the inflammation. He says, "When the bladder is affected it becomes more susceptible of every kind of irritation, so that very disagreeable symptoms are often produced; it will not allow of the usual distension, and therefore the patient cannot retain his water the ordinary time, and the moment the desire of making water takes place, he is obliged instantly to make it, with violent pain in the bladder, and still more in the glans penis, exactly similar to what happens in a fit of the stone. If the bladder be not allowed to discharge its contents immediately, the pain becomes almost intolerable; and even when the water is evacuated, there remains, for some time, a considerable pain both in the bladder and glans; because the very action of the muscular coat of the bladder becomes a cause of pain by its own contraction. The ureters, and even the kidneys, sometimes sympathize, when the bladder is either very much inflamed, or under a considerable degree of irritation; however, this but rarely happens, and, if it should take place with any degree of violence, I should suppose that the stomach would also become affected, and of course the whole constitution. I have even reason to suspect that the irritation may be communicated to the peritonæum by means of the *vas deferens.* * * * When the inflammation, or perhaps only the irritation, runs along, * * * the disease is generally very violent, and I suspect is something of the erysipelatous kind; at least it shows an irritable sympathizing habit." (pp. 55, 6.)

The constitution scarcely ever is primarily affected on the incursion of gonorrhœa; but HUNTER mentions one very remarkable case of this kind, in which the patient, during six weeks between "the time it was possible for him to have contracted the disease, and its appearance," had, "for a considerable part of that time, often been indisposed with slight rigors, attended with a little fever and restlessness, for which he could assign no cause; nor was he relieved by the usual remedies prescribed in such cases. A violent gonorrhœa came on, and these symptoms went off." In a second attack which the same person suffered, "it was a month from the time of infection before the gonorrhœa appeared, and for some weeks of that time he was subject to a similar indisposition, which went off, as before, when the running came on. Here, it would appear, that we have something of a suppurative fever, which, perhaps, often happens in this disease; but the inflammation being small, and the fever, therefore, inconsiderable, it is commonly but little noticed by the patient." (p. 73.)

(a) MS. Lectures on Surgery.

156. The continuance of these symptoms varies. In slight cases they soon pass by, the discharge gradually diminishes, and (under proper management, commonly in from three to four weeks) completely ceases. Frequently, it becomes chronic, and the discharge (*gleet*) assumes a thin serous ropy character, appears in very small quantity, especially in the morning, after emptying the bladder or after any irritation, and may in this state continue for many months or even years.

["The discharge from gonorrhœa is very much affected by constitutional causes," says **Astley Cooper.** Thus, if with "abundant discharge, considerable pain, and even chordee, the patient should get a fever, the discharge disappears, the pain ceases, and he will be entirely free from all symptoms of the disease for a period of from seventeen to twenty days. As soon, however, as he begins to recover from his fever, the discharge of matter will recur, the pain and chordee return, and a long time may elapse before the disease can be removed." (p. 191.)]

157. The consequences of gonorrhœa by the changes it produces on the mucous membrane of the urethra are thickening, narrowing, stricture, and swelling of the prostate gland.

158. In the female the vagina is the seat of gonorrhœa. The inflammation spreads externally upon the labia, urethra and clitoris. Painful tickling arises in these parts, and soon a copious flow of differently conditioned mucus takes place which produces excoriation, and the gonorrhœa is easily propagated to the rectum (1). The voidance of urine is painful. The symptoms of gonorrhœa are generally less distinct in women than in men; the mucous discharge, however, soon becomes chronic and very obstinate. The detailed symptoms, the manner of its origin, as well as the occurrence of menstruation and the unchanged colour of the face, distinguish female gonorrhœa from the whites (*fluor albus* vel *leucorrhœa*) (2).

[(1) When the urethra had been affected with the disease, **Ricord** states, that "on introducing the finger into the vagina, and pressing the convexity of the urethra, pus was seen to proceed from the interior of the canal, whose surface, as seen through the *meatus urinarius*, appeared swollen." (p. 173; Fr. edit., p. 332.) "The acute urethritis is seldom accompanied by retention of urine, and, when it does exist, it is generally of short duration, and yields to antiphlogistic treatment; but, nevertheless, sometimes it requires the use of the catheter, which ought to be introduced with the parts exposed, notwithstanding the objections raised, as less pain will be caused than if the surgeon have to feel his way." (p. 322; Fr. edit., p. 678.)

In the five cases which **Ricord** describes as utero-vaginal gonorrhœa, and which inoculation proved not to be syphilitic, there was, besides a purulent discharge from the mouth of the womb, upon the *cervix uteri*, "either an ulceration in form of a blister, (p. 161; Fr. edit., p. 310); or several points deeply eroded with a grayish surface, covered with albuminous adhering secretion (p. 162; Fr. edit., p. 313); or a bleeding ulceration (p. 166; Fr. edit., p. 320); or a superficial granulated ulceration, penetrating to the cavity of the *cervix uteri* (p. 172; Fr. edit., p. 332); or erosion at several points, as in some cases of balanitis." (p. 175; Fr. edit., p. 335.)

Hunter says that "sometimes the bladder sympathises, producing the same symptoms as in men, and it is probable that the irritation may be communicated to the kidneys. It has been asserted that the ovaria are sometimes affected in a similar way to the testicles in men; I have never seen a case of this kind, and I should very much doubt of its existence, for we have no instance in other diseases of the ovaria sympathising with those parts or at least producing such symptoms as would enable us to determine they did." (p. 68.) **Ricord**, however, does believe in the occurrence of ovaritis as a complication of gonorrhœa, and speaks of its treatmeant.

Not unfrequently the labia swell under a sharp attack of gonorrhœa, and the nymphæ, together with the *præputium clitoridis*, become infiltrated with serum, and of considerable size, giving to the latter an appearance of being twisted, similar to that sometimes observed in phimosis, or paraphimosis, in the male. Hence **Ricord** compares it to "a kind of phimosis or paraphimosis," and he speaks of it as occasionally terminating in gangrene, which, however, I do not recollect to have observed.

Abscesses in the labia or nymphæ are not of unfrequent occurrence as concomitants with gonorrhœa, and Hunter considers them "as similar to the inflammation and suppurations of the glands of the urethra in men." (p. 68.) RICORD speaks of simple abscesses complicating urethro-genital gonorrhœa; but I cannot clearly make out whether he refers to the labial or nymphal abscesses just mentioned, or to abscess actually in the vagina itself; if the latter, I have never seen the disease. He says:—"These abscesses sometimes depend upon the inflammation of the cysts, which some women have at the entrance of the vulva; in all cases they ought to be promptly opened. It should be noted that suppuration here quickly succeeds to inflammation, and, if the pus be not allowed to escape, infiltration of the loose cellular tissue surrounding the rectum, and, lastly, perforation of this intestine, thus forming either complete or incomplete fistules." (p. 323; Fr. edit., p. 680.)

(2) The distinction between clap and the whites in women is by no means so easy as CHELIUS presumes; indeed, according to Dr. LOCOCK's (*a*) account of the latter, it is scarcely possible to distinguish them, except by the history, which is not always to be relied on. LOCOCK says:—"The discharge of simple leucorrhœa is mucous—merely an increase of the natural moisture of the part; it becomes more abundant than in health, but retains its character of mucus, being clear, transparent, colourless and glutinous to the touch. This rarely goes on to a great extent without being altered in its appearance, and much more watery. In general this sort of discharge is accompanied with but moderate symptoms, is more gradual in its progress, and is unattended with pain; there is little or no inflammatory action present. In other cases the discharge is whitish and opaque, becomes creamy when rubbed between the fingers, and rendering water turbid. This sort of discharge has been considered by Sir CHARLES M. CLARKE andothers to depend on an inflamed condition of the *cervix uteri;* it is rarely abundant, but occasions much disorder of health and local pain. A watery discharge resembling serum is a very common result of more acute inflammatory action in the mucous surface, and, in general, appears suddenly as the effect of cold or any active excitement. It occasionally becomes very abundant, is attended with much local heat and soreness, and soon becomes puriform or mixed with purulent matter, and sometimes with bloody streaks. When it is fetid, brown, or coming away in violent gushes, organic disease of the uterus is to be feared, the nature of which can only be ascertained by an examination *per vaginam.* Purulent discharge from inflammatory action may also take place from the vagina, independent of gonorrhœa from impure connexion; and this may be said to form one variety of leucorrhœa, as, although it may often arise from organic disease of the uterus, it is not unfrequently met with in a perfectly healthy state of that organ." (p. 35.) "In the mildest form of the disease," LOCOCK observes, "the menstruation is either scanty or too profuse:" thus, its presence cannot be considered as distinctive of gonorrhœa, or its absence of leucorrhœa, as presumed by CHELIUS. "The most acute form of leucorrhœa is," proceeds LOCOCK, "most commonly the effect of cold, of metastasis, or of some local irritating cause, and consists of a profuse watery or purulent discharge, accompanied with local pain and soreness; the vagina is hot, very tender to the touch. * * * All these forms may end in chronic leucorrhœa, where the discharge is more or less profuse and constant, mucous, or purulent, or a mixture of both; it may become green and offensive, and yet may be the result only of functional disorder. The quantity poured out is sometimes very abundant, even to the extent of a pint and a half in twenty-four hours; it will then be expelled in gushes in any change of posture." (p. 36.) Unless the symptoms of debility resulting from this state of things be checked, the patient dies exhausted.

In summing up, LOCOCK makes the following excellent and judicious observations:—"It is important to be able to distinguish between gonorrhœa and common leucorrhœa; * * * but it is very doubtful whether any very accurate diagnosis can be formed. It has been stated that in a recent gonorrhœa there is *ardor urinæ* which does not accompany leucorrhœa, unless unusually acrid. But how are we to distinguish in a case of this unusually acrid leucorrhœa, or where a gonorrhœa is not recent? The redness and tumefaction of the labia, nymphæ, &c., can only be seen in a recent gonorrhœa, and they may be seen in severe cases of leucorrhœa, particularly in those following local irritation, or possessing more acute inflammatory action. One other test is mentioned by authors, that in leucorrhœa the discharge ceases during menstruation, but does not in gonorrhœa. This, however, is denied by other authors, and, as Dr. JEWEL observes, "this is a point which cannot easily be decided, as, from the colour of the menstrual secretion, that of the leucorrhœal or gonorrhœal must necessarily be in a great measure obliterated." (pp. 38, 9.)

(*a*) See his article on *Leucorrhœa*; in Cyclopædia of Practical Medicine, vol. iii.

It will be here convenient to notice the *pudendal discharges* which occur very frequently in female children soon after birth, which are generally purulent, and produce redness and swelling of the external generative organs, and not seldom accompanied with excoriation and sloughing of the skin, which may, as I have seen it, more than once or twice, extend to the upper part of the thighs, in consequence of the irritating nature of the discharge. LOCOCK says:—"It is very apt to occur also during dentition, and not only when the first set of teeth are in progress, but at the time of the second set, and even when the *dentes sapientiæ* are irritating the system at a mature age." (p. 39.) I do not recollect to have noticed it at these latter periods, but have no doubt of the correctness of LOCOCK's observation.

A knowledge of this occurrence is highly necessary, and is very properly insisted on, as there is no doubt that many men have suffered capital punishment from the ignorance of practitioners on this point. And, even now, with our better knowledge, it is by no means unfrequent to hear of medical men giving a decided opinion, which is almost certainly erroneous, upon the gonorrhœal character of pudendal discharges, and thus jeoparding the character, if not the life, of an innocent person. On all occasions of giving opinion or evidence in such cases the practitioner is bound to speak with extreme caution, and only upon the most incontestible proof, which, on the mere examination of the parts, it is almost impossible for him to attain, to make a positive statement as to the gonorrhœal character of the discharge.

It is also to be remembered that an epidemic vaginal catarrh has occasionally happened, as mentioned by Dr. PERCIVAL (*a*), at Manchester, in 1791; by Dr. FERRIAR (*b*), in 1789 and 1790; by Dr. MACKINTOSH (*c*), at Edinburgh; by KINDER WOOD (*d*), at Oldham, in 1815; and by CAPURON (*e*).

159. As to the *nature* of gonorrhœa (1) and its connexion with the venereal disease the following distinctions are laid down:—

1. Gonorrhœa *arising without infection*, *from external injury*, for instance, hard riding, blows upon the urethra, onanism, too frequent connexion, introduction of foreign bodies into the urethra and so on; or *from internal disturbance*, as herpetic, or gouty humours, repelled eruptions, suppressed secretions and so on (2).

2. Gonorrhœa *depending on peculiar contagious* matter, the influence of which, however, does not spread beyond the urethra (3).

3. Gonorrhœa *which has a venereal origin*, rather as consequence of general venereal disease, or as a primary syphilitic affection with or without ulceration. This kind of gonorrhœa may pass into general venereal disease (4).

[(1) The only kinds of gonorrhœa which can be admitted are two, the *gonorrhœa benigna* and *gonorrhœa virulenta*, "the terms *benigna* and *virulenta*," as LAWRENCE (*f*) observes, "not indicating the mildness or severity of the symptoms, but denoting the causes which produce those symptoms. *Virulenta* generally means that which is produced by the morbific or poisonous state of gonorrhœa; the other term (*benigna*) indicates any other cause that may excite inflammation of the urethra." (p. 776.)

(2) HUNTER (*g*) even observes, that "sometimes discharges happen spontaneously, when no immediate cause can be assigned; such may be called *simple gonorrhœas*, and have nothing of the venereal infection in them, though those that have been formerly subject to virulent gonorrhœas are most liable to them." (p. 34.) He (*h*) mentions, also, a remarkable case arising from sympathy with the cutting of a tooth. "A boy, about two years of age, was taken with a pain and difficulty in making water, and voided *matter from the urethra*. I suspected, by some means or other, this child might possibly be affected by the venereal poison; and the suspicion naturally fell on the nurse. These complaints sometimes abated, and would go off altogether, and then return again. It was observed, at last, that they returned only upon his cutting a new tooth. This happened

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(*a*) On the Uncertainty in the External Signs of Rape; in Medical Ethics, Notes and Illustrations to, p. 231. Manchester, 1803. 8vo.

(*b*) Medical Histories and Reflections. Warrington, 1792. 8vo. 2nd Edit. (here quoted,) vol. i., p. 169. London, 1810. 4 vols. 8vo.

(*c*) Elements of Pathology and Practice of Physic, vol. ii. p. 303. Edinburgh, 1830. 2 vols. 8vo.

(*d*) History of a very fatal affection of the Pudendum of Female Children; in Med.-Chir. Trans., vol. vii. p. 84.

(*e*) Traité des Maladies des Femmes depuis la Pubesté, &c. Paris, 1817. 8vo, p. 212.

(*f*) Lectures in Lancet, above quoted, 1830. vol. ii.

(*g*) On the Venereal Disease.

(*h*) The Natural History of the Human Teeth, &c. London, 1803. 3rd Edition. 4to.

so often, regularly and constantly, that there was no reason to doubt but that it was owing to that cause." (p. 245.)

Everard Home (*a*) says, he has "known a simple gonorrhœa to be brought on by the internal use of arsenic, and to continue for some time after that medicine has been left off, and then disappear. He has also known it to be a consequence of the internal use of ginger." (*note*, p. 35.)

The discharge from the urethra which often arises in men after connexion with their wives, whilst labouring under leucorrhœa either in its mild or acute form, may be placed under this head. It sometimes is very severe. **Hunter** mentions a case of this kind. "The parties have been married these twenty years and upwards; the wife has, for many years past, been at times troubled with the *fluor albus.* When he has connexion with her at such times, it generally, though not always, produces an excoriation of the glans and prepuce, and a considerable discharge from the urethra, attended with a slight pain. These symptoms commonly take a considerable time to go off, whether treated as a gonorrhœa or as a weakness." **Hunter** asks: "Is this a new poison? and does it go no farther because the connexion takes place only between two? What would be the consequence if she were to have connexion with other men, and these with other women? or if he were to be connected with other women? Such cases, as far as I have seen, have only been in form of a gonorrhœa; they have not produced sores in the parts, nor, as far as I know, do they ever produce constitutional diseases." (p. 65.) All the discharges above enumerated must be included under the designation of *gonorrhœa benigna* seu *simplex.*

(3) With regard to the second kind of gonorrhœa, mentioned by **Chelius** as "depending on peculiar contagious matter," it is doubtless the so-called *gonorrhœa virulenta*; but I cannot agree with him that its "influence does not spread beyond the urethra," as, from the observations of other surgeons, as well as from my own, I am convinced that, in certain persons, it does become a constitutional disease, and exhibit distinctive characters, although even **Lawrence** says that "gonorrhœa consists of inflammation of a mucous surface, that of the urethra or vagina going through a certain course, coming to a natural end, and not attended with further effect than those which immediately occur in the parts conceived." (p. 810.)

[The following observation of **Abernethy's**, is too important to pass by as coming from so high an authority, though I do not agree with it. "I am ready to affirm," says he, "that I have of late years seen as little of what was called *Gonorrhœa virulenta* when I was a young surgeon as I have of the syphilitic chancre. The *Gonorrhœa virulenta* was a most active inflammation in the front part of the urethra, the discharge was of very thick pus, having a peculiar and very fetid odour. The disease began by degrees, but soon attained a considerable height, and continued on an average for three weeks; at which time, or shortly afterwards, the inflammatory actions ceased, the discharge became less consistent, and lost its characteristic fetor. The running, however, still continued, and occasionally for a great length of time, rather, as it appeared, in consequence of the disturbance induced, than as an immediate effect of the disease; for I have known instances where the gonorrhœa has ceased without leaving any afterclap or gleet; and many in which this symptom, when it occurred, has been of very short duration." (p. 276.)

(4) It seems now generally admitted that gonorrhœa and syphilis are two decidedly distinct diseases, and therefore **Chelius's** third division, "Gonorrhœa with a venereal origin," will not hold. The question of the identity of the diseases has been long and fiercely disputed in the schools; but the observations and experiments of **Hernandez** and **Ricord** have, to my mind however, put the matter completely at rest.

Of the existence of gonorrhœa, at least as early as the beginning of the 14th century, there seems to me no doubt. **Beckett** (*b*), indeed, says, (quoting from **Stow's** Survey of London,) as early as the year 1162, "divers constitutions relating to the Lordship of Winchester were to be kept for ever according to the customs from time immemorial, among which it is ordered, that 'no stewholder keep any woman that hath the perilous *infirmity of burning.*'" **John of Gatesden**, who practised about the year 1320, and was a fellow of Merton College, Oxford, wrote the *Rosa Anglicana,* in which, among other things, he treats *De Leprâ*, and, in one of the sections on this subject, entitled, "De infectione ex coitu leprosi vel leprose," he says, "Primo notandum ut ille qui timet de *excoriatione et arsura virgæ* post coitum statim lavet virgam cum aqua mixta aceto vel cum urina propria et nihil mali habebit. Secundo, oportet dicere mulieri

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(*a*) J. **Hunter** on Venereal Disease.

(*b*) An Attempt to prove the Antiquity of the Venereal Disease long before the Discovery of the West Indies, in a letter to Dr. **James Douglas**; in Phil. Transact., 1718, No. 357, p. 839.

supposite ut saltet retro, descendat fortiter per gradus et sternutet cum pulvere piperis vel cum penna in aceto in naribus, ita ut sperma prius receptum descendat, et tunc lavet se in decoctione rosæ et plantaginis decoctarum in vino et furfure, et tunc erit secura." (p. 61) (*a*). JOHN OF ARDEN, who lived through the greater part of this century, and at the age of seventy years, in the year 1377, wrote "propria suâ manu," the MS. No. 75 of the Sloanian Collection, however, speaks, in another MS. No. 2002 of the same collection, of the disease "qui dicitur *Chaude-pisse*;" and BECKETT quotes from another MS. a prescription of his, "contra *Incendium*," which I have not been able to find.

On the other hand, the generality of Surgical writers presume that syphilis had not existed prior to the discovery of America, in 1492, or the siege of Naples, in 1495. I am not, however, by any means sure that even syphilis with its primary sores in shape of chancres, was not known to JOHN OF ARDEN, if not indeed also to JOHN OF GATESDEN, as hereafter I shall endeavour to prove. I have therefore merely referred to the presumed later appearance of syphilis that I may avail myself of the opinions of those who so think; but I believe that disease existed long before. It is not however, in reality, of much consequence, but simply a matter of literary curiosity, because the decision of the question rests not there, but upon the experiments mentioned by BENJ. BELL, and more especially on those performed by HERNANDEZ and RICORD.

"Although," HUNTER says, "it has been supposed by many, that the gonorrhœa and the chancre arise from two distinct poisons; and their opinion seems to have some foundation, when we consider only the different appearances of the two diseases, and the different methods of cure; which, in judging of the nature of many diseases, is too often all we have to go by: yet if we take up this question upon other grounds, and also have recourse to experiments, the result of which we can absolutely depend upon, we shall find this notion to be erroneous." He proceeds to inquire into the introduction of the venereal poison among the inhabitants of the South Sea Islands, combats the opinion that chancre was first introduced into Otaheite, by stating that it was "almost impossible to carry a chancre so long a voyage without its destroying the penis; while we know from experience that gonorrhœa may continue for a great length of time;" and determines, for this reason, and also that "only a gonorrhœa can be cured by simple means," which seem all that the natives adopted, "that the disease they had must have been a gonorrhœa," (p. 14;) and "that every form of the disease has been propagated from one root, which was most probably a gonorrhœa." He then continues:—"If any doubt still remains with respect to the two diseases being of the same nature, it will be removed by considering that the matter produced in both, is of the same kind, and has the same properties; the proofs of which are that the matter of a gonorrhœa will produce either a gonorrhœa, a chancre, or the lues venerea; and the matter of a chancre will also produce either a gonorrhœa, a chancre, or the lues venerea." (p. 16.) To make this circle complete he ought to show that the matter of lues venerea will produce gonorrhœa; but he distinctly states:—"It has never yet been known to produce a gonorrhœa from the constitution." (p. 308.) It must be here observed that HUNTER considers chancre and lues venerea two distinct forms of the disease, the one primarily exhibiting it locally, and the other only through the constitution.

"To account for these two different effects of the same poison," HUNTER observes, "it is only necessary to observe the difference in the mode of action of the parts affected when irritated, let the irritation be what it may. The gonorrhœa always proceeds from a secreting surface, and the chancre is formed on a non-secreting surface. * * * The poison, then, being the same in both cases, why do they not always happen together in the same person? * * * Although it does not often happen so, yet it sometimes does, at least there is great reason to believe so. I have seen cases where a gonorrhœa came on, and in a few days after in some, in others in as many weeks, a chancre has appeared; and I have also seen cases where a chancre came first, and, in the course of its cure, a running and pain in making water have succeeded. It may be supposed that the two diseases arose from the original infection, and only appeared at different times. * * * I suspect," he proceeds, "that the presence of one irritation in these parts, becomes in general, a preventive of the other. I have already observed that the two parts sympathise in their diseases, and it is possible that that very sympathy may prevent the appearance of the real disease; for, if an action has already taken place which is not venereal, it is probable that this sympathy will not cease while the cause exciting it exists; and therefore when both happen in the same person at the same time, I suspect that either the urethra never had sympathised with the chancre, or if it did at first that sympathy had ceased, and then the venereal matter might stimulate the parts to action." (pp. 17, 18.) It is not at all clear what HUNTER means by this sympathy between the

(*a*) Edition of 1492. Pavia.

chancre and the urethra, or its absence; but it is very strange that he should seem to consider the simultaneous existence of gonorrhœa and chancre rare, as it is matter of daily occurrence.—J. F. S.

Benjamin Bell (*a*) denies the identity of gonorrhœa and syphilis. He says:—"The refusal of some patients to submit to the distress and inconveniency, the frequent result of a protracted mercurial course, and who, nevertheless, recovered from the usual symptoms of gonorrhœa, first suggested a doubt of the two diseases being produced by the same contagion. * * * The symptoms and consequences of gonorrhœa are perfectly different from those which take place in lues venerea. Both diseases have appeared, at different periods, in the same countries; and, in some instances, they have remained distinct and uncombined for a great length of time." (pp. 2, 3.) As to the assertion "that gonorrhœa sometimes terminates in pox, and, therefore, that this of itself is a sufficient proof of the two affections being of the same nature," he says, "Were it certain that this ever happened no further evidence would be required, as a few well-marked instances would be conclusive; but every unprejudiced practitioner will admit that no sufficient proofs of it have ever occurred. In order to support this opinion, data must be received which we know to be inadmissible. We must admit, that a person with chancres only communicates to another, not only every symptom of pox but of gonorrhœa, and that another, with gonorrhœa only, gives to all with whom he may have connexion, chancres with their various consequences. This ought, indeed, to be a very common occurrence, insomuch that every practitioner should be able to decide upon it with certainty, if this opinion was well founded. Instead of which, it will be admitted by all, that the one disease being produced by the other is, even in appearance, a very rare occurrence." (pp. 6, 7.) **Bell** subsequently observes:—"As a further proof of the difference of the contagions of syphilis and gonorrhœa it may be remarked, that no stage of pox has ever been known to induce gonorrhœa, which surely would occasionally happen if the two diseases were of the same nature. We may also remark, that, in numberless instances, people have been poxed by the matter of syphilis being by accident applied to a cut or a scratch, as often happens with surgeons in the dressing of chancres and buboes; but no one ever heard of a pox being got in this manner from the matter of gonorrhœa. It has been said that chancres may be produced by insinuating the matter of gonorrhœa beneath the skin. But experiments upon this subject are productive of such anxiety and distress, that they never have been, nor ever probably will be, repeated so frequently, as the nature of it would require." (pp. 32, 3.) He, however, mentions some experiments made by two young gentlemen upon themselves with a view to ascertain the point in dispute. * * * By the introduction of the matter of chancres as well as of buboes into the urethra, some pain and irritation were excited, but *no gonorrhœa ensued*; and, by fretting the skin of the prepuce and glans with a lancet, and rubbing the parts with the matter of gonorrhœa, slight sores were produced, but they never assumed the appearance of chancres, and they healed easily without mercury." (p. 34.)

Bell flatly denies **Hunter**'s assertion, that "at Otaheite every form of the (venereal) disease has been propagated from one root, which, most probably, was a gonorrhœa;" by his statement, "when Captain **Cook** visited these islands, in his second voyage, we have authority for saying that *gonorrhœa* had not then appeared in them." (p. 36.)

Having thus given an abstract of the opinions of **Hunter** and **Bell** as to the dispute on the identity of gonorrhœa with syphilis, it only remains to show that **Bell**'s opinion that, for the reasons above assigned, experiments upon this subject "never probably will be repeated so frequently as the nature of the case requires," can no longer be maintained, as most conclusive experiments have been most ably and numerously made by **Hernandez** and **Ricord**, by which the distinct nature of the two diseases is completely proved.

Hernandez (*b*) had the opportunity of making his observations on galley-slaves, over whom he had perfect control. From these he selected three who had gonorrhœa, to furnish the necessary virus with which he experimented; and he justly observes:—"These experiments, made on seventeen persons, are the most numerous and perhaps the most careful that have been made, and furnish important results. In five of these cases the cure was quick, without internal remedies, and without the ulcers having any venereal appearance. In the others, there were obstinate ulcers, some possessing quite the syphilitic appearance, accompanied with general symptoms which seemed to confirm it. Surely such proofs did not exist in the cases I have mentioned, and yet they were regarded as decisive. Yet all depended upon known internal disorders; all the ulcers yielded to means calculated to destroy these disorders, but which have no virtue in syphilis. * * * My experi-

(*a*) Quoted at the head of this article, vol. i.

(*b*) Essai Analytique sur la Nonidentité des Virus Gonorrhoïque et Syphilitique. Toulon, 1812. Quoted from **Ricord**.

ments prove that the ulcers which are produced, by inoculating the gonorrhœal virus, are not syphilitic, and at the same time point out the source of errors which may render these experiments, which appear so simple and decisive, of little value. They show how circumstances may change the nature of ulcers, or disguise them, and to such degree that it may easily impose on inattentive observers who do not foresee these cases of complication." (pp. 48, 9; Fr. edit., pp. 112–13.)

The assertion that "one woman, having connexion with several men, could give chancres to some, and to others gonorrhœas and buboes, whence the conclusion as to the identity of the nature of these different actions, the principle being always the same in all, and the difference only in the form determined by the locality and degree in which the cause acts," is now completely disproved by Ricord's observations:—"If such reasoning have remained for a length of time without refutation, it cannot," says he, "be now persisted in. Since I have applied the *speculum uteri* to the study of venereal diseases, the hitherto inexplicable enigmas are reduced to the most common and simple facts. With the aid of this instrument I have found that a woman may be affected, at the same time, with gonorrhœa and deep chancres of the vagina or uterus and the gonorrhœa alone show itself externally; apparently affected with gonorrhœa, she could very easily communicate chancres and gonorrhœa together, or only one of them, according to the predisposition of the persons who exposed themselves to the infection. But we can affirm, and from numerous observations, that whenever we have examined women who have communicated disease, we never found that a chancre had been produced by a discharge without ulceration in the sexual organs of the person who had communicated. Inoculation has confirmed what observation of ordinary contagion, better made with the assistance of the *speculum*, had established. In women, gonorrhœa, considered throughout, in the whole extent of the organs of generation, in its different phases of acuteness or duration, and inoculated in the same manner as employed for chancre, produced no result, whenever the mucous membrane was not actually the seat of chancre." (pp. 52, 3; Fr. edit., pp. 118, 19.)

In reference to the opinion that "the cause of chancre and gonorrhœa being the same, the difference in the form depended upon the tissues affected, and that thus the syphilitic virus applied to a non-secreting surface produced a chancre, and the pus of chancre, upon mucous membranes only, produced gonorrhœa," Ricord says, positively:—"We know that gonorrhœal matter never produces chancre on the skin, and that, applied to mucous surfaces, when it acts, it only produces a discharge. The gonorrhœal secretion, applied to the mucous membrane of the eye, has never produced chancres of the conjunctive coat, or of the eyelids, nor, on the other hand, *has the muco-purulent secretion of gonorrhœal ophthalmia ever produced chancres by inoculation or otherwise*, although the eyelids are susceptible of being affected by chancre. We may add that the muco-pus of a balanitis or posthitis, consequent on an impure coition, or produced artificially by an irritant, has never furnished a result by inoculation, and that these affections, therefore, cannot be followed by symptoms of constitutional pox, whenever they have existed without chancres." (p. 58; Fr. edit., pp. 129–31.) In regard to the two "pretty frequent and regular consecutive symptoms of gonorrhœa, buboes, (yet far less frequent than after chancre,) and swelled testicle, I have ascertained, by inoculation, [that the pus from such buboes, the buboes being then in similar condition, does not inoculate, which, in this case, rarely terminate in suppuration, and with engorgements, or simple abscesses, the characters of which frequently correspond to strumous and not syphilitic affections. As to swelled testicle, which still more rarely suppurates, the pus never produced any thing by inoculation." (p. 58; Fr. edit., p. 132.)

The following are the inferences which Ricord draws from his observations on the inoculation of gonorrhœal matter:—

"1. The matter of gonorrhœa, applied to a healthy mucous membrane, causes gonorrhœal inflammation, so much the more easily, the nearer it approaches the purulent form, and therefore, contrary to the opinion of Whateley, the less mucous its nature.

"2. Under no circumstances can it produce chancre; but, as an irritating matter, like that of coryza for instance, it may excoriate the skin, with which it remains some time in contact, but it never produces a specific ulcer.

"3. The consecutive, undoubted, and regular symptoms of gonorrhœa do not furnish an inoculable pus.

"4. The symptoms of constitutional syphilis are not the consequence of gonorrhœa. In all the cases in which authors mention that it was an antecedent, the frequency of which precisely corresponds with that of masked chancres, (*chancres larvés*,) the diagnosis was not correct; the diseased surfaces not having been examined.

"5. Lastly, the only correct means of diagnosis, in the present state of science, is inoculation. Every gonorrhœa which is tested by inoculation in its various periods, without producing any result, is only a simple affection, and incapable of communicating syphilis, whether primary in another subject, or constitutional in the one first affected." (p. 59; Fr. edit., p. 133.)

It is very commonly held by those who consider gonorrhœa and syphilis as distinct diseases, that in the former there is not ulceration, the gonorrhœa being, as described by **Wallace** (a), a "diffused and superficial disease, with increased and altered secretion, but *without loss of substance* or ulceration." (p. 233.) But, as **Ricord** observes, it is well known and proved by pathological anatomy, that, as the speculum shows us every day, gonorrhœa is often accompanied or followed by erosions, or more or less extensive destructions of the mucous membranes; but the ulcerated form of gonorrhœa, if I may thus express myself, does not render it more capable of being inoculated than that which is not; the gonorrhœal ulcers being essentially distinct from chancre." (p. 53; Fr. edit., p. 119.)

The best account of gonorrhœal sores and their consequences is certainly that given by **Travers** (b).

"The distinguishing features of sores produced by gonorrhœal matter are," says **Travers**, "circularity, flatness without induration, whether raised or level, with the surface; seldom solitary, often several; the greater frequency on the anterior and posterior verge of the perpuce, or beside the frænum, *i. e.* at the angles of reflection between the layers of the prepuce, or the close and loose investment of the glans, than elsewhere. In the female, they are likewise commonly situated at the junction of the mucous with the cuticular membrane upon the labia, or at their inferior commissure. Their margin is blunt, but not indurated; the character of the granulation is spongy and indolent, and, though they clean readily, they heal slowly." (p. 13.)

"The proper gonorrhœa, or inflammatory secretion from the sound mucous lining of the urethra, while confined to it," says **Travers**, "is incapable of producing secondary symptoms to the individual; its bubo, if present, is sympathetic, so is the sore throat, or inflamed membrane of the eye or nose, if one or all should follow; *i. e.* they have no character but that of simple and superficial membranous inflammation. As these unquestionably do sometimes follow, though in so slight a degree as to be scarcely noticeable, the circumstance can only be explained by attributing it to the same *consensus partium* which determines the selection of these parts for the specific appearances when the matter of secretion is absorbed, and acts as a morbid poison. But, when the matter of gonorrhœa is absorbed by an excoriated surface, and this surface becomes an ulcer, the matter which it secretes is capable of producing, by its absorption into the system, secondary symptoms in the individual. The absence of secondary symptoms in pure gonorrhœa depends, therefore, not upon any difference in the quality of the matter, but upon a law of the animal economy, *that the inflammatory secretions of the sound surface are not absorbed into the system.*" (pp. 10, 11.)

"The secondary symptoms of the gonorrhœal sore are as strongly marked," continues **Travers**, "present as distinct a character as those of lues. The glands in the groin are oftener large and indurated, than otherwise, in protracted cases; but, as in proper gonorrhœa, the affection is sympathetic. The appearance of secondary symptoms is certainly not peculiar to these cases. The inflammation of the *velum palati* and uvula is diffuse and superficial; the surface is roughened with innumerable small and shallow indentations where ulceration has taken place. They are so slight as often to escape ordinary observation. They are seen chiefly upon the tonsils, uvula, apex, and edges of the tongue. * * * The gonorrhœal sore throat is accompanied by considerable irritability to stimulant fluids especially. The exacerbated ulcer of lues, with its abrupt high-coloured margin, is not more strongly characterized, or more readily distinguished. The cutaneous affections are slight, and, in character, presenting less variety than those of lues, so far as my observation enables me to speak. The papular and squamous are the most common, the pustular and tubercular occasional. The lichen and psoriasis upon the trunk and limbs, and the achor and acne indurata thickly distributed upon the face and the verge of the hairy scalp, are the forms which I have chiefly recognised." (pp. 14, 15.)

With regard to the gonorrhœal sore throat, since it was first pointed out, many years since, by **Travers**, I have continually observed it, I think quite as frequently when there was merely discharge without any sore, as when with it; and so surely does it accompany gonorrhœa that, if perceived in the throat, I invariably inquire if the patient have a clap, and scarcely remember to have found it absent. I think it has a very close resemblance to the non-specific aphthous sores in the mouth and throat indicative of mucous irritation in the bowels, and the sores are generally about the size, or somewhat less, than a silver penny, and are commonly accompanied with fulness of both tonsils and uvula.

(a) Quoted at the head of the article.

(b) Above cited.

I feel also pretty well assured that some eruptive affections of the skin are consequent on gonorrhœa, which are distinguished by their pinky stain from the copper stain of syphilis. But I am doubtful whether I have seen more than acne, lichen, and lepra.—J. F. S.]

160. The *diagnosis* of these several kinds of gonorrhœa is in many cases obscure and not to be determined with certainty by characteristic symptoms; but its mild course, the short continuance of the discharge, the condition of the patient previous to the disease, the perhaps ascertained state of health of the person from whom the contagion has been received, in most cases furnish the guide. All gonorrhœa which has a malignant course, in which swelling of the testicles, inflammation of the inguinal and of the prostate glands occur, may be considered as syphilitic. In syphilitic gonorrhœa of women the danger of general syphilis is always greater than in men, on account of the copious secretion of mucus, and the excoriations thereby produced.

[Almost all that can be said on the diagnosis of vaginal discharges has been already mentioned, in speaking of gonorrhœa in women, and leucorrhœa at *par.* 158. The contagious gonorrhœa, or true gonorrhœa of both women and men, has also been shown to be a disease distinct from syphilis, and, therefore, the swelling of the testicles, the inflammation of the inguinal and prostate glands are not to be considered, as CHELIUS holds them to be, syphilitic, but merely sympathetic, and not requiring the treatment necessary for the cure of syphilitic affections. HUNTER observes, in reference to this circumstance:—"It sometimes happens, although but seldom, that the glands of the groin are affected in a common gonorrhœa with the appearance of beginning buboes, but which I suspect to be similar to the swelling of the testicle, that is merely sympathetic. The pain they give is very trifling, when compared with that of true venereal swellings, arising from the absorption of matter: and they seldom suppurate." (p. 61.) COOPER agrees with HUNTER that "buboes of this kind rarely suppurate, but only in very irritable constitutions. He distinguishes sympathetic from syphilitic bubo by "one gland only, in general, being enlarged in syphilis, but in a sympathetic bubo most frequently a chain of glands is affected. Of the two sets of glands in the groin, one just above POUPART'S ligament, and the other about two inches, or two and a half inches, below it; the lower tier is seldom enlarged from sympathy, the upper frequently." (p. 269.)

That discharges from both the male and female genitals have produced, in some instances, gonorrhœa, and in other chancres, every one who has had the slightest opportunity must have observed; and hence has arisen the opinion, long held by many surgeons, that the diseases were one and the same. But the examination of the vagina with the speculum, so largely practised, and on such good grounds strongly advocated by RICORD, explains the cause of these two sets of symptoms, by showing that in the vagina, and often even on the *cervix uteri*, chancres may exist, whence may be produced a discharge, which, without such examination, carelessly pronounced to be gonorrhœa, will cause chancre, or, if accompanied with gonorrhœa, may produce in one person chancre, in another gonorrhœa, and in a third both diseases at the same time, whilst the infecting party is presumed merely to have gonorrhœa. The use of the speculum, therefore, if only as a mean diagnosis, cannot be too strongly advised. In males it cannot be employed to examine the urethra; in such cases, therefore, it is well if the practitioner have any cause for suspicion, to inoculate the matter from the urethra into the patient himself. If the discharge be simply gonorrhœal, no inconvenience will ensue; but, if a chancrous sore should follow the inoculation, it is a proof that the disease is syphilitic, and that it must be treated accordingly.

For the examination of the public prostitutes RICORD lays down some rules which, under any circumstances where suspicious discharges from the female genitals exist, should always be followed. "The examination ought here," says he, "to be neither slight nor illusive; not only should the external part of the organs be examined, but also the internal and more concealed, for the source of the poison which it is wished to avoid, often lies in the depth of the vagina, on the *cervix uteri*, or even in its cavity; and in these cases neither an external examination, nor the *toucher* would suffice, and the speculum alone can warn them of their danger." (p. 255; Fr. edit., p. 540.)

This able surgeon has also shown the importance of inoculating discharges from the sexual organs, in regard to medico-legal questions as to venereal diseases. "In questions of rape, for instance, the consequences of syphilitic infection are often brought forward as a proof. Well! what practitioner would not, in the present state of science, seeing a man, affected with gonorrhœa, accused of having violated a woman actually infected with chancre, have regarded this pretended coincidence as a proof of great value? But when it is incontestibly known that chancre alone can produce chancre, if the gonorrhœal muco-pus of the individual supposed to be guilty, produces nothing upon inoculation, after having been properly tried, will it not be evident, in a case of recent infection, that he cannot be convicted? And, again, would it not be proved by the same mode of experimenting, that individuals accused of having communicated the pox, which must aggravate the position of all persons thus accused, have only caused by mechanical violence, or by the action of some morbid or normal secretion, simple inflammations." (p. 94; Fr. edit., p. 197.)

161. The *cure* of gonorrhœa is directed by its severity.

In slight cases the patient should drink whey, almond emulsion, linseed tea and such like, a mild diet used, abstinence from all irritating or heating things; rest, support of the testicles with suspensory bandage, frequent bathing of the penis in luke-warm water, which subsequently, also, for the sake of cleanliness, is to be continued.

If the inflammation and pain be more severe, the following additional treatment according to circumstances must be resorted to; bleeding, leeches at the root of the penis or its neighbourhood, and softening bread poultices.

Purgatives, recommended by many in gonorrhœa, are generally more hurtful than useful, and, if necessary on account of impurities in the bowels, should be of the mildest kind, as manna, tamarinds, and not salts, which irritate the urinary passages.

["The venereal inflammation (or rather the gonorrhœal inflammation—J. F. S.) is not kept up," says HUNTER, "by the pus which is formed, but, like many other specific diseases, by the specific quality of the inflammation itself. This inflammation, however, it would appear, can only last a limited time; the symptoms peculiar to it vanishing of themselves, by the parts becoming less and less susceptible of irritation. This circumstance is not peculiar to this particular form of the venereal disease; it is perhaps common to almost every disease that can affect the human body. * * * As the living principle in many diseases is not capable of continuing the same action, it also loses this power in the present, when the disease is in the form of a gonorrhœa, and the effect is at last stopped, the irritation ceasing gradually. This cessation will vary according to circumstances; for, if the irritated parts are in a state very susceptible of such irritations, in all probability their action will be more violent and continue longer: but, in all cases, the difference must arise from the difference in the constitution, and not from any difference in the poison itself. The circumstance of the disease ceasing spontaneously, only happens when it attacks a secreting surface and when a secretion of pus is produced. * * * Gonorrhœa cures itself, whilst the other forms of the disease require the assistance of art. (pp. 36, 7.) Gonorrhœa may be cured while there is a chancre, and *vice versâ*." (p. 38.) (It is very remarkable that, with these facts staring him in the face, HUNTER should have persisted in his opinion that gonorrhœa and chancre were one and the same disease.—J. F. S.) "How far the gonorrhœa in women is capable of wearing itself out, as in men, I cannot absolutely determine; but am much inclined to believe that it would: for I have known many women who have got rid of a violent gonorrhœa without using any means to cure it; and indeed the great variety of methods of cure made use of in such cases, all of which cannot possibly do good, though the patients get well, seems to confirm this opinion." (p. 59.)

HUNTER has made an observation in regard to gonorrhœa, which every one who has had the least experience must accord with, viz., that it is "the most uncertain in the cure of any of the forms of this disease; many cases terminating in a week, while others continue for months, though under the same treatment. The only thing necessary to be done for the cure is to destroy the disposition and specific mode of action in the solids of the parts, and as that is changed the poisonous quality of the matter produced will also be destroyed." (p. 75.) This latter observation does not very well tally with what he says almost immediately after:—"We have no specific medicine for gonorrhœa," although he comforts himself with "it is therefore very reasonable to suppose that every such inflammation gets well of itself; yet, although this appears to be nearly the truth, it is worthy of consideration whether medicine can be of any service in this form of the disease. I am inclined to believe it is very seldom of any kind of use, perhaps not once in ten cases." (p. 75.) "I believe," Hunter subsequently observes, "the soothing plan is best at the beginning. * * * In cases where the symptoms run high, nothing should be done that may tend to stop the discharge, either by internal or external means, for by this nothing would be gained; as merely stopping the discharge does not put an end to the inflammation. The constitution is to be altered, if possible, by remedies adapted to each disposition, with a view to alter the actions of the parts arising from such dispositions, and reduce the disease to its simple form. If the constitution cannot be altered, nothing is to be done but to allow the parts to tire themselves out by a continuance of the same action." (p. 77.)

The employment of stimulating injections of various kinds, for the purpose of checking the discharge in gonorrhœa, has been a favourite practice with many surgeons, and even so long back as John of Arden they were used, but of a very mild character, as shown by his following prescription :—

"*Pro morbo qui dicitur Chaude-pisse.*—Accipe pursillam et coque in aqua donec in mucilaginem vertatur, quæ mucilago cum oleo rosæ et violæ fortiter agitetur addito lacte mulieris puellam nutrientis ana, in quo liquore dissolvatur camphoræ uncia una et pro syringam (injectionem) initiatur. Mucilago est quæ quædam viscositas admodum galature piscium vel earum anglicè gelee."—*MSS. Sloane*, 2002.

Translated by E. H., as follows : —

"Seethe the parsley in water till it come to a mucilage, that is, till the water be made green and slimy, and the substance of the herb be consumed. Then temper with that mucilage oil of roses and oil of violets and the milk of a woman nourishing a maiden child, and then dissolve therein one ounce of camphor, and by a syringe administer it."—*MSS. Sloane*, 2271.

Beckett mentions another prescription, which, however, I have not found :—

"*Contra Incendium.*—Item contra incendium virgæ virilis interius ex calore et excoriatione fiat talis syringa lenitiva. Accipe lac mulieris masculum nutrientis et parum zucarium, oleum violæ et ptisanæ quibus commixtis per syringam infundatur et si prædictis admiscueris lac amygdalarum melior erit medicina."

Abernethy objects to any attempt at checking gonorrhœa. "By endeavouring to arrest the disease in its progress," says he, "we are likely to induce irritation in the remote part of the urethra, and other affections; whereas if we merely soothe the malady, and allow it to take its natural course, it declines in due season, without, in general, producing any material injury to the part affected, or to any other in its vicinity." (p. 278.)

But patients will not be content to wait till a clap shall "decline in due season," although recommended so to do on the authority of Hunter and Abernethy. And it therefore becomes necessary to resort to some treatment for shortening the disease, and to relieve the often severe symptoms.

Abernethy's soothing practice is especially good when the inflammatory stage is very active, and is not unfrequently sufficient under ordinary circumstances; for Hunter's supposition, that "every such inflammation gets well of itself," is often true enough. Abernethy's plan consists in "bathing the perinæum and genitals with tepid water, by means of the bidet and sponge, for five or six minutes every night and morning; at the same time desiring them to wash beneath the fore-skin, so as to remove every thing lodged there, and to wash this part drawn well forward, and to protect the orifice of the urethra from mechanical irritation. * * * I also recommend those who are affected with clap to be very attentive to keeping their bowels in a regular state, because any inquietude in the bowels is likely to produce an irritable state of the urinary organs." (p. 278.)

I formerly adopted this soothing practice almost entirely, prescribing the following mixture :—℞ *magnes. sulph.* ʒi., *potass. nitr.* gr. v., *acac. pulv.* ʒi., *tinct. hyoscyam.* ♏v., *aq. destill.* ℥i., *ter quaterve in die;* under which treatment, either without or with mild injections of sulphate of zinc when all scalding had subsided, the disease was generally cured in ten days or a fortnight. Or I gave pills of the following composition :—℞ *tereb. chiæ* ℈ij., *pulv. rhei* ℈i., *syr. q. s.*, *et in pil.* xij. *dividend.;* four of these, twice a-day, were first given, and the number increased afterwards to six or eight as might be needed. But, of late, I have only employed the injection of a very mild solution of nitrate of silver, three grains to sixteen ounces of water, before the scalding ceases, and even when there is inflammation of the testicle, twice or thrice a-day, and I have never yet witnessed any ill effects; but the contrary, as, in two or three days the gonorrhœa is usually stopped.

Carmichael recommends injections into the male urethra twice a-day of a solution of nitrate of silver, ten grains to an ounce of water, for the purpose of cutting short the development of a gonorrhœa. I should be very sorry to follow such practice, as I should fear the almost certain production of stricture. But, if I used the nitrate of silver for this purpose, I should certainly, with Ricord, prefer the following method which he has employed, but does not speak of either in praise or dispraise. "I introduce into the urethra," says he, "Lallemand's caustic holder, and then, exposing the caustic, I withdraw it, at the same time giving it a rotatory motion, so as superficially to cauterize the whole of the mucous membrane of the urethra. If, after this first cauterization, too much inflammation supervene, recourse must be had to antiphlogistics, otherwise a similar cauterization should be made three or four days after the first." (p. 335; Fr. edit., 710 .)

The following was the plan adopted for many years by Astley Cooper:—In the first week, during which there is much inflammation, a draught of *magn. sulph.* ʒij., *inf. senn.* ℥jss., thrice a day, to produce active purging: diluting drinks of capillaire or tea, of which too much cannot be taken, and in which is to be taken daily *potass. carb.* vel *sod. subcarb.* ʒij. He found lime water a very excellent diluent, but did not care about mucilage, and considered the use of soda water very doubtful. If there were much scalding in passing the urine, or the pain from chordee were severe, he gave with advantage of *liq. potass.* ♏xx., *ext. conii.* gr.v., *ex mist. camph.* thrice a-day. The penis was kept for a long time in warm water, as a bath, to relieve the inflammation, and after a week overlaid with lint dipped in Goulard's wash. Three or four days after which, when the inflammation had greatly subsided, he gave a mixture of *bals. copaib.* ℥j., *mucil. acac.* ℥j., *mist. camph.* ℥iv., of which half an ounce was given night and morning. After persisting for two days longer in the use of this mixture, and the discharge being considerably lessened, he employed injections, three or four times a-day, of *liq. plumb. subacet. dilut.* ℥iv., *c. zinci sulph.* gr.vi. By this plan a gonorrhœa is safely and expeditiously cured. If the clap be a second or third, the balsam of copaiba may be given at once, and speedily stops the discharge. The strength of injections should be gradually increased, so as to produce slight irritation; but it is better to vary the kind of injection, *cupr. sulph.* gr. ss., *aq. distill.* ℥j., or *hydrargyr. oxymur.* gr.j., *aq. distill.* ℥xij. The use of bougies, though at first increasing the discharge, is often successful if accompanied with injections. (p. 193.)

In reference to the cure of gonorrhœa, Astley Cooper observes:—"It is difficult in proportion as the constitution of the patient is disposed to strumous affections. If a patient have pimples in his face, enlargement of the glands of the neck, a thin, delicate skin, and irritable fibre, you may expect to have great difficulty in curing him of gonorrhœa." (p. 191.)]

162. In very painful chordee (1) bleeding, leeches and soothing poultices must be employed. If the pain be not thereby diminished, if the patient be not plethoric, and the pain rather spasmodic, opium, hyoscyamus, camphor, poultices of narcotic vegetables and soothing clysters may be used with due carefulness. If, during the chordee, bleeding occur (2), the symptoms are usually much diminished; but, if it continue and become exhausting, attempts to allay it must be made by compression of the penis, by injection of a solution of gum arabic, and in very extreme cases by astringent injections.

[(1) Painful erections are generally controllable by the administration of a full dose of opium before retiring to rest, and by light bed-clothing. The same is also very useful in chordee, and a bottle of cold water placed between the legs, against the perinæum is a very efficient local application. Smearing the chordeed part with extract of belladonna is often useful, and, in obstinate chordee, I have used mercurial friction with advantage, even before it has become chronic. Astley Cooper recommends enveloping the penis at night in lint dipped in Goulard water, or the use of evaporating lotions. Ricord thinks camphor with opium either as a pill or an enema the most powerful internal remedy, and my own observation confirms his opinion. Hunter says, that "in relieving chordee, or the remains of it, which appear to arise from spasm, he has known the bark of great service." (p. 96.)

(2) When bleeding from the urethra occurs, it is generally rather beneficial than otherwise, and only requires control when severe. This may be effected by leading up the finger from the perinæum against the under surface of the urethra, till the point whence the blood escapes is found. The penis is then to be grasped between the thumb and

finger for a quarter of an hour or twenty minutes, which is generally successful. **Hunter** says, in such bleedings, he has "seen balsam of copaiba given internally of service," and supposes that "all the turpentines would be useful." (p. 95.) If, as **Ricord** states, though I have not observed it, "frequently the hæmorrhage return the first time the urine is passed; then, however objectionable it is to place a foreign substance in the inflamed urethra, we must introduce a bougie, which by compressing the vessels stays the effusion of blood. Sometimes additional circular external compression is required; but great caution must be used in its application. Generally this bougie may be removed after twenty-four hours; but, when the hæmorrhage has been great, and the instrument does not excite much pain, it is advisable to leave it a day or two longer. If the bougie have been removed too soon, and the hæmorrhage reappear, it must be reapplied, if it be not merely a sanguinolent discharge." (p. 339; Fr. edit., p. 717.)]

163. If the pain subside and the discharge diminish, a suitable treatment, with a slightly improved diet, with the avoidance, however, of all heating things usually suffices for the perfect cure. The frequent use of diluted fluids must be forbidden, lest by their too great relaxing power they might give rise to gleet. This must be especially attended to in otherwise flabby and scrofulous persons. For such cases we may recommend the use of *juniper rob*, *dulcamara*, *gum guaiacum*, *decoction of woods* and the like. If for a long time there remain a sparing discharge of serous fluid, slightly astringent injections of acetate of lead, sulphate of zinc, sublimate and so on, with opium, may be used to prevent the discharge becoming chronic.

164. In those cases in which a syphilitic form of gonorrhœa is suspected, after the inflammation is diminished or removed, mercury must be used for some time, or, together with a strengthening and tranquillizing diet, the use of decoction of woods must be persisted in, for the purpose of preventing the origin of general syphilis.

[It having been already shown that gonorrhœa and syphilis are distinct diseases, and do not generate each other, the treatment just mentioned is superfluous.—J. F. S.]

165. The treatment of gonorrhœa in women is precisely the same as that in men; but so strict an antiphlogistic management is not requisite; in general mild injections or steaming is sufficient to diminish the inflammation. Astringent injections are to be used and made stronger, if the discharge be inclined to become chronic. The excoriated parts are to be covered with charpie spread with citrine or red precipitate ointment. The internal use of mercury, or the use of decoctions of wood, with strict attention to diet is then particularly necessary.

[I have never known it necessary, on account of the acuteness of gonorrhœal symptoms in women, to apply leeches, as recommended by **Ricord**; but, commonly, in all stages, unless there be inflammation and swelling of the external parts, employ injections of nitrate of silver, ten grains to an ounce of water once a-day; taking care that the vagina being well washed out, none of the injection should be left behind. This practice is fully confirmed by **Ricord**'s experience. He says:—"Sometimes acute gonorrhœa in women, whether complicated or not, resists the most judicious soothing treatment, and is aggravated by the use of mercurials. In some of these cases, in which the red and turgid mucous membranes afford a copious purulent discharge, attended with acute pain, which neither rest, depletion, emollients, nor narcotics can assuage, I have obtained astonishing results from the use of nitrate of silver. A superficial cauterization with solid nitrate of silver, or a solution of it, applied by means of lint, has favourably modified the inflamed surfaces, and produced a solution of the disease. After the use of the cautery, a plug of dry lint must be employed to prevent the contact of the walls of the vagina." (p. 324; Fr. edit. p. 683.)

Than these modes of treatment I do not know any better. Injections of acetate of lead, of decoction of tormentilla, of oak or elm bark and alum, are commonly recommended, but I do not consider them very efficient.

It must be borne in mind, in regard to stimulating injections, that some constitutions are more excitable than others, and, therefore, if the injections used excite considerable pain in the vagina, they must be either diminished in strength or entirely left off. **Home** (*a*) mentions the cases of two young women, who having been infected with gonorrhœa by the men who debauched them, and having used injections of the strength generally used for common women, had "the sides of the vagina united together by the adhesive inflammation." (p. 90.) Such cases are very rare, but serve as a caution in the use of these remedies.

If the inflammation be very severe, **Ricord**'s plan of introducing a plug of lint, dipped in emollient narcotic liquid, and renewed twice or thrice a day, so as to act as a poultice, may be useful, if, as he says, it can be effected without pain.

Ricord mentions that "some discharges, which resist all the above applications, seem to be maintained by the contact, even of the mucous membranes and the depth of the parts continually placed in the unfavourable conditions of heat and moisture." For these he has found good success by "filling the vagina, without much distending it, with dry lint, renewed two or three times a-day, according to the quantity of the discharge, which, in the cases that terminated successfully, was white and milky, and proceeded from the vagina alone." * * * "Ulcerations and papulous granulations are to be cauterized with nitrate of silver, which is to be preferred, or with nitrate of mercury on lint." (p. 326; Fr. edit., p. 686.)

Of ulcerations of the mucous membrane of the womb, I have no personal experience; but **Ricord** says that, "we must here, as in the ulcerations of other parts, modify the surfaces in a more powerful manner; but the greatest precautions are necessary in cauterizing the interior of so delicate an organ, the reaction of which would be so powerful; for, whilst the strongest caustics applied to the cervix generally produce no pain, fluids scarce possessing any caustic properties, being introduced into the cavity of the uterus, may cause the most serious consequences." Of which he instances, from the use of an injection of one part of nitrate of mercury to eight of water, very violent hysterical attacks in some patients, and, in one, "a cerebral congestion which caused a momentary apprehension of apoplexy. These symptoms, which all arose a few minutes after the injections, yielded rapidly to antispasmodics, and, in the case with the cerebral congestion, on a quantity of blood being taken from the arm." He then used one part of nitrate of mercury to twelve of water; but these injections were not always unattended with pain, or some nervous reaction of a hysterical character. I then substituted," says he, "six grains of nitrate of silver to the ounce of water, and found that, in some instances, a chronic purulent uterine discharge was cured after two or three injections." (p. 327; Fr. edit., p. 689.)

When "vegetations originate in the interior of the urethra, constituting what were formerly termed caruncles and carnosities, they maintain discharges which cease when they are destroyed by incision or cauterization." (p. 328; Fr. edit., p. 691.)

When the urethra is affected with gonorrhœa, injections are recommended by **Ricord** to be used as in men, the fluid being prevented from passing into the bladder, by pressing the back of the urethra against the pubes.]

166. If the discharge become chronic, it is usually long-continued, and, upon the least excess, the smarting and burning in making water return. The many remedies advised against gleet must be used with due attention to the causes from whence it has originated. It may be caused by *weakness*, by a *morbidly increased insensibility*, and by *organic changes in the mucous membrane of the urethra.*

In the *first* case, balsamic stimulating remedies are to be employed, balsam of copaiva in gradually increasing doses, gum kino; astringent injections of acetate of lead, sulphate of zinc and copper, of sublimate; washing the penis with spirituous fluids and so on. In the *second* (which in sensitive persons sets in very soon, if the inflammatory stage of the gonorrhœa be improperly treated) all stimulating and exciting remedies will be injurious. **Haller**'s acid in a decoction of salep must be administered internally; in very high sensibility a dose of opium, or of *aqua lauro-cerasi* in emulsion, must be given frequently during the day. In this case only are injections of decoction of red foxglove, of poppy-seed emulsion, with laurel water, with opium and so on of service. The patient

(*a*) Note in **Hunter** on the Venereal.

must carefully avoid every excess. In the *third* case, when ulceration, stricture, or diseased changes of the prostate are present, the patient complains of pain at a certain point when touched and in making water. If the discharged fluid be frequently streaked with blood, it indicates an ulcer, in which case, a suitable antisyphilitic treatment, sublimate as injection, and the use of bougies, is necessary.

[Chronic gonorrhœa is commonly known by the name of *Gleet*, and is generally a thin transparent discharge unattended with pain, but under any excitement or excess it becomes white, yellow, or greenish, and, if the excitement be great, even tinged with blood; in fact, the gonorrhœal inflammation is re-excited. Astley Cooper considers it to "proceed from the lacunæ of the urethra," in other words, from the usual seat of gonorrhœa. But it is often a concomitant of stricture, and sometimes the use of a bougie will reproduce inflammatory action, and an increased discharge, capable of bringing on a yellow discharge, with pain in making water in the female, as happened in a case mentioned by Astley Cooper. (p. 272.) And he observes:—"Gleet is said to be that stage of gonorrhœa where the discharge ceases to be infectious. I doubt whether there is such a complaint as gleet, according to this definition, for I cannot help believing that a gonorrhœa never ceases to be infectious. * * * I doubt whether a gonorrhœa ever loses its power of causing infection as long as any discharge from the urethra remains." (p. 270.) He mentions instances, the first, in which infection followed a gonorrhœa of five months and three days, and the second after fourteen months. But Hunter gives a more remarkable instance, in which a girl, who had been for two years in the Magdalen Hospital, infected a person immediately after leaving that house. (p. 40.) And Tyrrel (*a*) says, that he "saw a case once, where the gleet had existed for six or seven years, and had resisted various means, both local and constitutional, that had been tried for its cure." He tried in this case, "touching the under part of the urethra, just opposite the frænum, with caustic. This application, for the time, stopped the discharge, but, as soon as the slough came away, it returned just as before, in the quantity of four or five drops a-day." (pp. 566, 7.) Hence it appears that the disease will continue a great length of time.

It is said that gleet resulting from gonorrhœa, may be distinguished from gleet accompanying stricture; but I very much doubt it, and I think Cooper's case, above cited, in which the man, whose stricture was irritated by the bougie, clapped his wife, supports my notion. Tyrrel, however, mentions the distinction between the two as follows:—"If the gleet is merely gonorrhœal, there will be a tingling sensation behind the frænum, and, if the patient indulges in excess of any kind, or takes too violent exercise, this, together with the quantity of the discharge, will be increased. If you ask the patient how he voids his urine, he will say, that the stream is free and uninterrupted to near the extremity of the passage; then, that it stops for an instant, and afterwards passes very well; this symptom arises from the accumulation of the discharge near the lacunæ. On the contrary, if there is stricture, the patient voids his urine very badly; and this is influenced very considerably by change of weather, or by irregular conduct on the part of the patient; and, if you inquire more minutely, you will find that the stream of urine is small and completely twisted." (p. 567.)

Astley Cooper speaks of the possibility of confounding gonorrhœa or gleet with abscess in the lacunæ; the latter, however, he observes, "may be always known by its being absent for a week or more, and then flowing profusely, but not so in a gonorrhœa. And the matter from an abscess of the lacunæ is not infectious, whilst the discharge, which begins a gonorrhœa and terminates in a gleet, never loses its power of producing infection." (p. 271.)

In deciding upon the cure of gleet, let it never be forgotten that, so long as only six or eight drops of the discharge are observed during the day, or even if the lips of the urethra be merely moist with it, on rising in the morning, the cure is not effected, and the person ought not to marry, or he will infect his wife.—J. F. S.]

Astley Cooper's treatment of gleet consisted in the use of the following medicines:—℞ *spir. æther nitr.* ʒij., *bals. copaib.* ʒi., *muc. acac.* ℥i., *mist. camph.* ℥iv.: *ft. mist. cujus capiantur coch. magn. bis terve indies*; or, should that fail, ℞ *pulv. lytt.* gr.¼, *tereb. chiæ* gr.v. *pro pil. bis terve quotid. sumend.* As to local treatment, he employed bougies, either simply smeared with oil, or with *ung. hydr. mitius*, or *ung. hydr. nitr. oxyd.* The latter first in proportion of a scruple of the salt to an ounce, and gradually increased in strength; using at the same time injections, "from which there would be no danger of stricture, as the bougie would prevent it." The injection he preferred was *hydrarg.*

(*a*) Clinical Lecture on Gleet; in Lancet, 1824. vol. ii.

bichlorid. gr.¼, *aq.* ℥iij., and gradually increased up to half a grain to an ounce. (p. 272.)

A generous diet is necessary in cases where the gleet continues, and not unfrequently it is found advantageous for the patient to take wine. Balsam of copaiva, either in mixture or in capsules, is often very serviceable in addition to injections, of which I prefer that of nitrate of silver. When the gleet continues very obstinate, there is reason to suppose, as stated by HUNTER, that stricture exists, and it is then necessary to use the bougie.

RICORD mentions that "inoculation of a new gonorrhœa has been advised, and is still perpetrated by many practitioners, either to cure a chronic discharge, or to combat, by revulsion, symptoms which gonorrhœa may produce, such as epididymitis, ophthalmia, &c. Some, in this case are content with advising a new infecting coition; others make a kind of inoculation with the muco-pus of gonorrhœa, carried on a probe into the urethra, or applied to the mucous membrane it is wished to infect, by means of a bit of lint which is impregnated with it. * * * However, were I not convinced that the cases in which it is useful to recall an old discharge, or develop a new one, are as rare as some persons think them frequent, and that they have either aggravated the disease they wish to combat, or given it a new complication, I would not apply the muco-pus of a gonorrhœa of one individual to another before having ascertained, upon the one from whom it is taken, that it produces nothing when inoculated with the lancet; otherwise, without this precaution, a patient with gonorrhœal symptoms might be affected with masked chancres, (*chancres larvés*,) and communicate to an individual, who till then had only a simple catarrhal affection, without further consequences, all the formidable chances of syphilis." (p. 89; Fr. edit., pp. 188, 9.)

I have noticed these proposals for the cure of obstinate gleet, or other consequence of gonorrhœa, merely to point out their absurdity; as I presume no one, excepting those whose treatment of disease is founded on the *similia similibus, eadem iisdem* principle, could seriously think of adopting them. The moral conduct involved in the attempt to acquire a new gonorrhœa to put an end to an old one, is about on a par with that of commerce with an uninfected person for the same purpose, (a vulgar notion which was formerly held,) and the benefit from either alike.—J. F. S.]

167. The mode of treating gonorrhœa already mentioned is founded upon the various degrees and nature of this complaint. Of late *cubebs* have been recommended by many practitioners as the most effectual remedy against it, and, according to my own experience, I must accede to the good report of it given by others, and especially by DELPECH. This remedy operates upon the gonorrhœa not merely, as many suppose, when the inflammatory period has passed over, but it performs its good offices in every stage of the disease. The principal point in the use of cubebs is, that they should be genuine, and given in sufficiently strong doses. With small doses of cubebs the gonorrhœa is commonly increased. At the onset, at least half an ounce a day should be given, which should be much increased if no special symptoms ensue. In many cases DELPECH gave four doses daily of two or three drachms each without producing any peculiar symptoms; it is, however, better to divide the doses and give them more frequently. If required to act briskly and for some time, it is most advisable to give a dose every three or four hours, and meal times should be regulated accordingly, or a dose taken even during the night. The usual consequence of this remedy is a gentle warmth in the belly, not always accompanied by an increase of thirst, which generally ceases in a few days, even when the dose of cubebs is increased. If therefore this symptom pass by, it is not necessary to discontinue the remedy; but, if it continue, and pain in the belly be produced, the doses must be diminished to two or three; it may then do good, but its operation on the disease is more tedious. In many cases the remedy produces frequent, thin stools with or without pain in the belly, very rarely accompanied with tenesmus, but never with discharge of bloody mucus. In such cases the remedy must be withheld,

solid food forbidden for some days, mucilaginous drinks taken, and then the medicine resumed in the same doses as before, or in smaller ones. Frequently this symptom is the consequence of gastric irritation, which may be relieved by an emetic, and then the earlier or stronger doses may be used. Some persons bear this remedy only when given at meal-time, or when food is taken with it. In many cases where it cannot be endured balsam of copaiva, according to Delpech's experience, is useful; but, when that causes purging, cubebs must be employed. Frequently do the cubebs produce no satisfactory alteration; but in no instance is the disease thereby rendered worse. In recent gonorrhœa the burning, the heat, the not very severe pain, and the discharge soon diminish, the latter becomes serous, and in two or three days the whole has passed off. The same occurs with the slighter claps, even when they are of longer standing. Three doses daily of two drachms each are sufficient in these cases. More severe gonorrhœæ in the second or third week, with severe pain, chordee, and so on, yield less easily and only to larger doses. Improvement also takes place very rapidly; the chordee frequently continues longest, but often subsides after a blister, when every thing else fails. Also in those cases in which the inflammation has extended to the neck of the bladder accompanied with discharge mixed with blood, with severe inflammation, with swelling of the prostate glands, if the pain was exceedingly severe, and in swelling of the testicle, this remedy was very efficient. Old and painless swellings of the testicle remaining after acute affection, which were connected with symptoms of general infection, and had even withstood antisyphilitic treatment, yielded to the use of the cubebs, even although general syphilitic disease continued. The same occurred in the swellings of the inguinal glands, if depending on gonorrhœa. During the use of cubebs a mild diet and rest must be observed. The remedies must be continued for at least eight days after all symptoms have disappeared.

Delpech has disproved by numerous observations that cubebs can produce inflammation of the testicles as by some supposed. Previous to using cubebs Delpech had given balsam of copaiva in large doses in all stages of gonorrhœa with good effect. Both remedies, according to recent observations, contain an analogous substance. Perhaps the inefficiency of cubebs, when properly administered, may prove the peculiar syphilitic nature of the gonorrhœa. In order to prevent the general infection, Delpech, when the gonorrhœal inflammation is not too great, uses at the same time twelve to fifteen rubbings-in of half a drachm of mercurial ointment night and morning on both sides of the penis.

Velpeau (*a*) employs cubebs and balsam of copaiva in clysters; two, four, six, or eight drachms rubbed down with yolk of egg or with decoction of marsh-mallows.

Michaelis (*b*) has tried cubebs on many patients who were suffering from gonorrhœa, and only in one single case, in which gleet had existed for a short time, did he observe a cure. Just as inefficient did he find it in the whites and in chronic catarrh of the lungs.

Richon and De Salle have given, as they assert, with great effect, thirty drops of tincture of iodine night and morning in gonorrhœa. In some cases, leeches were first applied to the urethra, and an antiphlogistic diet coupled with it.

[Astley Cooper was a great advocate for the use of cubebs. He said it " appears to produce a specific inflammation of its own on the urethra, which has the effect of superseding the gonorrhœal inflammation. * * * In the very early stages of gonorrhœa, when the inflammation is just beginning, it often succeeds in removing the disease in a very short space of time." But he observes :—" I do not say that it would be advisable to employ this remedy at once for a first gonorrhœa, where the symptoms of inflammation run very high in a young and irritable person; it is better not to begin with the use of it until a week or ten days have elapsed, and the inflammation is considerably reduced." He thinks it " a most useful remedy also for the cure of gleet, as it is called,

(*a*) Archives Générales de Médecine, Jan. 1827. (*b*) Journal of Graefe und Walther, vol v. p. 70.

where gonorrhœa has continued for a length of time." And also that "the greatest advantage may be derived from combining its use with that of copaiba, when the balsam alone is beginning to lose its effect," and he gives it as a mixture, viz., "An ounce of the balsam of copaiba, an ounce of the mucilage of acacia, two drachms of cubebs, in four ounces of camphor mixture." (pp. 146, 7.)

For my own part, I may state that I have used cubebs very freely in all stages of clap and gleet, but not with the advantage attributed to it. I do not think it superior to other of the usual treatments, and it often produces much annoyance from loading the stomach. If used, I think it is better to employ it in the shape of extract, as pills, in which form, also, copaiba is prepared, and may be used in like manner. But the more common mode now of exhibiting copaiba in private practice is in little capsules of caoutchouc. Some years ago we were in the habit of using, at St. Thomas's Hospital, the following copaiba mixture, which was very efficacious, and had the advantage of rarely disagreeing with the stomach, a matter of much consequence if the medicine be long persisted in:—℞ *bals. copaib.*, *spir. æther. nitr.* āā ♏xl., *tinct. hyoscyam.*, *liq. potass.* āā ♏xx., *ex aquâ ter die sumend.* If necessary to increase the quantity of the balsam, a proportionate quantity of mucilage is added.—J. F. S.]

On the use of cubebs or Java pepper see

CRAWFORD, J., on the Effects of the Piper Cubeba in curing Gonorrhœa; in Edinb. Med. and Surg. Journal, Jan., 1818, p. 32.

ADAMS, J., A short Account of Cubebs as a Remedy for Gonorrhœa. Ib., Jan., 1819 p. 61.

JEFFREYS, HENRY, Practical Observations on the Use of Cubebs or Java Pepper in the Cure of Gonorrhœa. London, 1821. 8vo.

MAKLY, M., in London Medical and Physical Journal. 1821, June.

BROUGHTON, S. D., in Medico-Chirurg. Trans., vol. xii. p. 100.

DELPECH, Mémoire sur l'Emploi du Piper Cubeba dans le Traitement de la Gonorrhée; en Révue Médicale, May, 1822, p. 1; June, 1822, p. 129.

HEYFELDER, über die Anwendung des Bals. Copaivæ und des Piper Cubeba; in Heidelberg. Med. Annalen, vol. iii. part iv.

HACKER, über der Copaiva-Balsam beim Tripper; in Summarium der Med., vol. viii. part i. 1839.

168. *External Gonorrhœa* (*Gonorrhœa Glandis*, *Balanitis*, *Posthitis*, Lat.; *Eicheltripper*, Germ.; *Blennorrhagie externe*, Fr.) is either a mere consequence of want of cleanliness, in which case the sebaceous matter secreted by the odoriferous glands collects and becomes acrid; hence it particularly occurs with a lengthened narrow prepuce, or is consequent on syphilitic infection. The latter may always be guessed at when it follows suspicious connexion, is connected with excoriation, and is obstinate.

[HUNTER believes, that, "when the disease attacks the glans and other external parts, as the prepuce, it is principally in those persons whose glans is commonly covered with the prepuce, and it is principally about the root of that body and at the beginning of the prepuce, the parts where the cuticle is thinnest, and of course where the poison gets most readily to the cutis; but, sometimes, it extends over all the glans and also the whole external surface of the prepuce. It produces there a soreness or tenderness, with a secretion of thin matter commonly without either excoriation or ulceration. I am not certain, however, that it does not sometimes excoriate those parts; for I once saw a case where the whole cuticle came off the glans." (p. 44.) I have seen this condition not at all unfrequently; it is quite distinct from any syphilitic affection. Excoriation with little or no discharge often happens to young persons, even children, simply from the acridity of the secretion of the odoriferous glands; and I have seen it produce violent inflammation and swelling of the prepuce, and threatening mortification. It frequently recurs and is very troublesome.—J. F. S.]

In *Gonorrhœa of the Glans which is not syphilitic* the observation of great cleanliness, frequent washing of the glans with tepid milk, lead wash, and so on, are sufficient for the cure. In the syphilitic form, mercury must be used both externally and internally.

[The simple treatment recommended by **Chelius** is generally quite sufficient; mercury is never needed. " When the glans can be uncovered and the inflammation is not excessive," **Ricord** says, the method he has " found best succeed, is passing the pencil of nitrate of silver gently over the diseased surfaces, so as to cauterize them superficially, after which it is sufficient to put a bit of dry lint round the glans and draw the prepuce over again. Lotions of lead wash or cold water are to be applied over." (p. 331; Fr. ed., p. 669.) This is very good practice, but I commonly use only a little black wash. —J. F. S.]

[168*. *Gonorrhœa of the nose* sometimes occurs during gonorrhœa of the urethra, or whilst there is an enlargement of the testicle from the same cause. The Schneiderian membrane is tender over its whole surface, but not painful; is of a deep red colour, but not ulcerated; and there is a free discharge similar to that of clap.

This disease was first noticed by **Benjamin Bell**, and he mentions two cases of it: in the first, " the discharge from the urethra lessened before the testes became inflamed, and, on this taking place from the nose, it ceased entirely." It was treated with an astringent lotion and the insertion of sponge moistened in it up the nose, and cured in a few days. In the second case, " the discharge took place during the continuance, and had existed many years, and, although it had frequently become less, it never disappeared entirely." Various attempts at its cure were made without success, " and, though no other symptom appeared, he was advised to undergo a course of mercury; but no advantage ensued." (pp. 29, 30.)—J. F. S.]

169. In the treatment of *Gonorrhœa*, of which the ground is a *gouty* or *herpetic* disease, and so on, that given for the non-syphilitic gonorrhœa is suitable; but in these cases the inflammation is usually long-continued, even when the disease has run into a chronic form. Then especially must be employed purging, warm bathing, preparations of sulphur, antimony, and so on.

V.—OF INFLAMMATION OF THE TESTICLE.

170. *Inflammation of the Testicle* (*Inflammatio Testiculi*, *Orchitis*, *Hernia humoralis*, Lat.; *Hodenentzündung*, Germ.) may be produced by different causes.

[" In some instances," as observed by **Benjamin Bell**, and it might be added, specially during or after gonorrhœa, " both testicles swell. They seldom, however, swell both at once; but the swelling, on leaving one testicle, is very apt to go to the other; and when both have, in this manner, been affected, they sometimes swell alternately for a considerable time together. I have known this happen for the space of a year and upwards, where the patient, during the whole period, was never completely free of the disease." (p. 337.)]

First. It occurs most frequently in gonorrhœa, either with a very high degree of inflammation, with dragging pains in the belly and pelvis if the patient move about much, and the testicles be unsupported; in which case, the inflammation extending to the testicles, first attacks the epididymis, and next the whole gland; or it confines itself merely to the former (*Epididymitis*;) or it may be produced when the inflammatory symptoms have declined, by any irritation of the testicle, violent exercise, for instance.

[**Hunter** remarks very justly, of the singularity of swelling of the testicle not coming on " when the inflammation of the urethra is at its height; he thinks it happens when the irritation is going off, and sometimes even after it has entirely ceased, and when the patient conceives himself to be quite well." (p. 60.)]

Second. It may be a symptom of general syphilis.

[Even **Hunter** says:—" I believe the swelling of the testicle, like the affection of the bladder, and many of the symptoms mentioned before, is only sympathetical, and *not to be reckoned venereal;* because the same symptoms follow every kind of irritation on the urethra, whether produced by strictures, injections, or bougies. It may be observed here, that those symptoms are not similar to the actions arising from the application of the true venereal matter, whether by absorption or otherwise; for they seldom or ever suppurate, and when suppuration happens, the matter produced is not venereal." (p. 57.)

ASTLEY COOPER holds with CHELIUS's opinion. He says:—"I have seen this organ, (the testicle) so frequently enlarged during the existence of secondary symptoms of syphilis, more especially in combination with a cutaneous and periosteal venereal affection—and have observed it additionally swollen and painful in the evening, although relieved by the recumbent posture in bed—and known it yield so easily and readily to the influence of mercury, and just in proportion to the disappearance of the venereal symptoms, that I think it quite unreasonable to doubt its liability to be affected by the venereal poison. * * * The testicle and epididymis become four or five times their natural size. The pain which accompanies the disease is not severe, but it is increased towards evening. When one testicle is enlarged, the other is apt to become affected; and, I think, in the majority of cases, that the disease exists in both testicles. * * * It is rarely a concomitant of the syphilitic sore throat only; but it frequently accompanies the venereal eruption and periosteal inflammation. The distinguishing mark of this disease from the simple chronic enlargement of the testicle, will be found in its succeeding syphilitic symptoms, and often in its being combined with those I have mentioned, as well as in its obeying the law of syphilis, viz., of its being liable to an evening exacerbation. (pp. 102-4.) I am sure I have seen such enlargements of the testicle combined with syphilis, and that their best mode of treatment is similar to that for iritis. * * * I feel assured that the testicle becomes affected during the progress and influence of the syphilitic poison upon the body, in some persons; and that mercury, whilst it subdues the other symptoms, is also the only cure for this disease." (p. 110.) Eight cases are given by COOPER in support of his opinion of the syphilitic character of this enlargement. RICORD also agrees with COOPER: he says:—"Syphilitic sarcocele must not be confounded with gonorrhœal epididymitis; * * * it is seldom found as a sole sign of a secondary affection, but is commonly preceded or accompanied by other symptoms of general infection; it frequently attacks only one testicle at a time. * * * The disease is frequently accompanied or preceded by nocturnal pains in the loins. The induration may have its seat in the epididymis or the cord; but it is the substance of the testicle which is almost invariably affected. Syphilitic sarcocele may often be complicated, which renders the diagnosis very obscure." (p. 303; Fr. edit., p. 640.)

Notwithstanding these high authorities, I must confess I have great doubt as to the swelling of the testicle depending on a syphilitic cause.—J. F. S.]

Third. It may be produced from external injury.

Fourth. From cold, especially in persons who sweat much, on the perinæum, and on the insides of the thighs.

Fififth. Violent exertions may produce increased congestion of blood to the testicle and, its return being impeded, may excite inflammation.

[HUNTER says he has "known the gout produce a swelling in the testicle, of the inflammatory kind, and therefore similar to the sympathetic swelling from a venereal (gonorrhœal—J. F. S.) cause, having many of its characteristics." (p. 60.)

ASTLEY COOPER mentions enlargement of the prostate gland in old age, as occasionally accompanied with swelling of the testicle; also inflammation of the neck of the bladder; a stone passing through the ureter, or pressing upon the commencement of the urethra from the bladder. This latter circumstance I have seen two or three times.

Another cause of mild, but sometimes severe, though easily manageable, inflammation of the testicle, is that arising from congestion of semen in the seminal tubes; which is of very frequent occurrence in lads soon after puberty. First one testicle is attacked with swelling, tenderness, and pain, which speedily subsides on taking a purge, and keeping quiet for a few days; but, in the course of four or five weeks, the other testicle is, in like manner, attacked. And when it gets well, the first affected is again attacked. This will go on for three or four years, to the patient's great inconvenience; but no danger is to be apprehended from it.—J. F. S.]

171. The inflammation of the testicle generally soon becomes acute. The testicle swells considerably, and the swelling is further increased by exudation into the cavity of the vaginal tunic; the skin of the purse is

expanded, reddened, and very painful, not unfrequently accompanied with fever, pain in the belly, disposition to vomit, with great weariness (1).

The usual termination of this inflammation is resolution (2). Dropsy of the vaginal tunic often remains if the inflammation be improperly treated, or if it continue in a less degree for a long time (3).

Suppuration is to be feared if in active inflammation the pain be throbbing. The skin then rises and thins at different parts; it bursts, the pus is discharged, and oftentimes the convoluted vessels of the testicle project from the opening of the abscess, like grayish-white flocculent bodies, which draw out when pulled, so that in the end the albugineous tunic remains empty (4).

Hardening is, on account of the peculiar condition of the testicle, no uncommon termination, specially if the treatment have not been exactly suitable, and scrofulous or gouty disposition be superadded. The bulk of the testicle is often distinctly increased by the hardening. Sometimes it confines itself merely to the epididymis, sometimes the whole testicle, and even a large or small part of the spermatic cord, is hardened (5).

Gangrene is a very rare termination, and only from improper treatment.

[(1) Astley Cooper observes:—"The first symptom of this disease, when it arises from sympathy with the urethra, is an irritation of the membranous or prostatic portion of their canal, as if some drops of urine still remained in the beginning of the urethra, and this is succeeded by a tenderness in the spermatic cord at the abdominal ring, and by swelling and pain in the epididymis. The testicle next swells. * * * The pain is obtuse, and more difficult to bear than that which is more acute, and it resembles the suffering which is produced by squeezing the testicle; and, indeed arises from the same cause, for the glandular structure of the testis swells, whilst the *tunica albuginea*, being tendinous and consequently inelastic, does not yield to the swelling from within, but resists its increase and presses upon the sensitive internal structure of the testicle, producing the dull, heavy, and aching pain of which the patient complains. The pain and swelling extend along the spermatic cord into the inguinal canal, producing great uneasiness in the groin and in the spinous process of the ilium, the hip, and the inner part of the thigh on the affected side, and at length fixes itself more particularly in the loin; and this arises from the renal and lumbar spermatic nerves having their principal origin from the renal and lumbar nerves. * * * The epididymis swells more in proportion than the testis, owing to its covering being less compact, and it remains longer swollen. Its two extremities, i. e. the *globus major* and *minor* are more affected than its body, and the swelling of the former is generally very perceptible before the spermatic cord." (pp. 8–10.)

Sometimes, though not very frequently, (for I have never observed it,) inflammation of the testicle, consequent on gonorrhœa, is immediately preceded by great irritation of the brain, which subsides on, or soon after, the appearance of the swelling. I am indebted to my intelligent friend Sams, of Lee, for the following

Case.—A. B., aged 19 years, of strumous constitution, had gonorrhœa for six weeks, and, after the usual treatment with purgatives, nitrous æther, and copaiba, the discharge had nearly ceased for two or three days, when he was attacked with violent febrile excitement, very quick pulse, and delirium, which continued forty-eight hours, towards the latter part of which the testicle began to swell, and, as the size increased, the head symptoms diminished and subsided. Leeches and other suitable treatment having been employed, the swelling of the testicle declined, and the gonorrhœa returned, but gradually diminished, till there was not more than six or eight drops of discharge a day. He then left the house, and took a walk, but soon had a recurrence of the febrile attack and head symptoms, which, however, went off again as the testicle again swelled, and that also subsided on the reappearance of the discharge from the urethra.—J. F. S.

(2) In general, as the inflammation of the testicle subsides, if the gonorrhœa had stopped, it reappears. Hence some surgeons have proposed its restoration, to cure orchitis.

(3) Adhesion and thickening of the *tunica vaginalis* is also a consequence of inflammation, and Astley Cooper observes that, "on examining the testicles which have felt

harder than usual, that one surface of the *tunica vaginalis* was glued to the other, in some cases partially, and in others entirely." (p. 21.)

(4) Suppuration is but rare when the inflammation of the testicle is sympathetic; thus forming one of the instances of the law on this point, recognised by JOHN HUNTER, and already adverted to in speaking of sympathetic bubo (*par* 160, *note*.) And, indeed, generally suppuration following inflammation of the testicle, from any cause, is not frequent. In these cases "the *tunica albuginea*," says ASTLEY COOPER, "like other tendinous structures possessing few absorbent vessels, does not readily give way to the pressure of the abscess; and it is a long time before it discharges itself, even after the matter can be distinguished by fluctuation. It generally breaks at several apertures, and sinuses follow, which are very difficult to heal, for they issue a seminal as well as a purulent discharge." (p. 12.)

Not unfrequently, after the bursting of an abscess in the testicle, a fungus shoots up, which often exceeds the size of the testicle. It is not painful and but little sensible; neither is it malignant, nor likely to become so, but it often grows very pertinaciously, and requires removal to get rid of its inconvenience.

The constitutional excitement is often very great, setting in with nausea, and followed by hot skin, furred tongue, quick pulse, and constipated bowels, and sometimes even with severe rigors.

It is scarcely possible to confuse orchitis with any other disease, on account of its ordinarily slow progress, and from the epididymis and the body of the testicle being, in general, readily discernible from each other, although much swollen. But SAMUEL COOPER has mentioned a case in which on the fifth day there was so much pain in the belly, accompanied with incessant vomiting, great constipation, and high constitutional disturbance, that it led to a presumption of a rupture, from which, however, it was distinguished by the want of particular protrusion at the ring, by absence of tension of the belly, to one side of which alone the pain was confined.

When swelling of the testicle arises from blows, it comes on very quickly, and doubtless depends on the bursting of some vessel or vessels in the testicle; and it may be complicated with hæmatocele or effusion of blood into the vaginal tunic.

"Wasting of the testicles," says ASTLEY COOPER, "is another effect of inflammation in this organ; and this absorption takes place more frequently at the age of puberty than at any other time;" generally follows inflammation from a blow; sometimes, when it arises spontaneously, and rarely after gonorrhœa, "it begins to be absorbed as the swelling subsides; but the absorption does not stop at the natural size of the part, but proceeds until the whole of the glandular structure of the organ is absorbed, leaving the *tunica vaginalis* adhering to the *tunica albuginea* and the *septa* within the latter; but the whole substance which remains is not larger than the extremity of the finger, and it feels a firm and very solid body." (pp. 23, 24.) Probably the tube of the *vas deferens* is obliterated, as its functions cease; for, in a preparation we have in St. Thomas's Museum, of a wasted testicle, the quicksilver would not descend to within an inch of the testicle.—J. F. S.

(5) ASTLEY COOPER says, that the globus major "is more frequently diseased than any other part of the testis or epididymis," an observation the correctness of which experience fully proves; and he might have added, that it is also of longer endurance, and more difficult to get rid of. "But," he observes, "the result is less important here than in other parts, because some of the *vasa efferentia* and *coni vasculosi* still carry the semen from the testicle to the epididymis. When the hardening is in the upper part of the epididymis, adhesive matter is effused into the cellular membrane, between the *coni vasculosi*, at their termination in the epididymis; and sometimes a sac, containing a mucilaginous fluid, is found at that part. The *coni vasculosi*, under this state of disease, are thickened, hardened, and of a dark brown colour." (p. 22.)]

172. The *Cure* of inflammation of the testicle is directed by its cause and degree. If consequent on gonorrhœa, still in its commencement, and connected with no great swelling, the patient must keep quiet, support the testicle, apply cold lotions of lead wash, lay softening bread-poultices upon the penis, and take a cooling purge. Cold applications, however, which are only to be used at the beginning when the swelling is small, frequently cannot be borne, in which case soothing fomentations and poultices are to be preferred. In greater inflammation, in robust persons, blood must be taken away or leeches applied in sufficient quantity

on the perinæum and inside of the thigh, and warm softening bread poultice applied on the swelling. If, after this treatment, although the inflammation is reduced, great pain still continue, opium with nitre or calomel must be given, opium clysters administered, and narcotic poultices applied. When the tension has diminished, lead wash may be added to the poultices. After the resolution of the inflammation, if the swelling of the testicle still remain for a long time, it must be supported by a suspensory bandage, and mercury with camphor rubbed in. According to Delpech's experience, the above-mentioned treatment of gonorrhœa, combined with cubebs, is sufficient to get rid of the inflammation of the testicle accompanying it.

[The general practice in swelling of the testicle is to adopt the antiphlogistic treatment, which practice I formerly pursued, giving, after a dose of rhubarb and calomel, either a dram of sulphate of magnesia three or four times a day, or tartarized antimony sufficient to produce nausea; and sometimes giving mercury internally, and using friction of mercurial ointment and camphor on the testicle till the mouth became affected. If the inflammation were very severe, cupping on the loins was employed, or local bleeding by leeches, or by opening two or three veins in the purse, and withdrawing three or four ounces of blood, and afterwards a warm bread poultice was applied. When the inflammation was subdued by these means, if the testicle still remained hard, as generally happened when no mercury had been used, then either mercurial friction or binding the testicle up in mercurial plaster was resorted to. Cold washes I never employed, nor have I any experience in the use of cubebs, as recommended by Delpech. I rarely now follow either of these plans, but prefer the use of compressing straps of adhesive or soap plaster, on Fricke's principle. (*pars.* 176, 7.)—J. F. S.]

173. If the inflammation run on to suppuration and an abscess be formed, this must be opened and treated in the usual manner. The whitish-gray *flocculi*, which lie in the opening of the abscess, must be left alone; they often become covered with granulations and are united with the opening. If the suppuration cannot be restrained and the testicle pass into disorganization, its removal is called for.

[When a fungus has sprouted from the aperture by which the pus has been discharged, it should be treated at first by brushing over with nitrate of silver, or solution of sulphate of copper, and then compressing it with circular strips of adhesive plaster. But, if this practice do not succeed, it may be cut off with a knife to the level of the skin, and the edges of the wound having been pared, to set the skin loose, it may be brought together, and treated as a simple incised wound, which usually effects the cure. Occasionally, however, though rarely, little abscesses are cut through in removing the fungus: as these descend more or less deeply into the body of the testicle, it is better to remove the entire gland at once; a case of which kind I have lately operated on. But under ordinary circumstances castration is neither required nor to be practised.—J. F. S.]

174. Hardening is for the most part confined to the epididymis, generally gives scarcely any pain, and may continue throughout life. In diseased dispositions and dyscracy, or from injuries which set up inflammation afresh, swelling of the spermatic cord, collections of water in the vaginal tunic, sarcomatous and cancerous hardenings are produced. The dispersion of the hardening may with proper care be attempted by the general remedies (*par.* 68) already mentioned, during which the testicles must be supported in a suspender. If the pain in the testicle become more severe and shooting, if the swelling be uneven and knobby, its extirpation is the only mode of preventing its passage into cancerous destruction. Not unfrequently, as a symptom of general venereal disease, a hard swelling of the testicle is slowly produced, which may generally be dispersed by a regular mercurial treatment or by the proper exhibition of cubebs (*par.* 167.) The hardening of the testicle from one gonorrhœa is not unfrequently dispersed by a fresh gonorrhœa; hence the proposition of passing bougies smeared

with red precipitate ointment, (not with gonorrhœal mucus,) to excite fresh inflammation of the urethra.

175. Inflammation of the testicle following mechanical violence or catching cold, is to be treated as above prescribed, (*par.* 172,) without reference to the inflammation of the urethra.

176. As in diffuse inflammation of the cellular tissue, its resolution has been attempted by continued pressure, (*par.* 91,) so Fricke (*a*) has recommended compression as the most effectual remedy in all cases of inflammatory swelling of the testicle, from whatever cause. The degree and duration of the inflammation are here of no consequence; but, if general illness, (for instance, actual gastric disease, be connected with it,) this treatment must be given up. Vascular reaction does not contraindicate compression, nor yet buboes nor sores. After compression the pain is at first frequently increased, and, if the pressure be too great, it is very severe; it does not, however, continue long, and, speedily, often within a quarter of an hour, the patient is free from pain. Frequently after compression gastric symptoms, as disposition to vomit, bitter taste and so on, occur, the compression must then be removed and a vomit given. If the pain continue after the compression, there must be some general disease causing this want of success. In severe traumatic *orchitis*, leeches first, and poultices for two or three days, must be used.

[I have, for some time past, adopted Fricke's practice of compression, with the greatest success, and rarely now use any other. I have occasionally heard it objected, that it produces so much pain, the patient cannot bear it, and that its removal is absolutely required. My experience is directly contrary to this assertion. I have had but two cases in which the compression was unbearable; whilst, on the other hand, all pain generally subsides in a quarter or half an hour. I feel, therefore, pretty certain, that the fault must rest with the mode in which the compression is applied, and not on the remedy itself. I think it far preferable to the old method of purging, or of making the mouth sore, which I, in common with many others, heretofore generally adopted, and therefore strongly recommend its employment, as an easy and speedy cure.

Very often under this treatment, as under the antiphlogistic, when the inflammation subsides, the discharge from the urethra returns. Sometimes, but not always, hardness of the epididymis remains for a long while; but I do not think it of material consequence.—J. F. S.]

177. For compressing the testicle, strips of new linen or sheeting, cut in the direction of the threads, should be used, a full thumb broad and an ell long, and spread by a machine with good sticking but not too irritating adhesive plaster. The patient, in slight cases, may place himself before his medical attendant, leaning against the wall, in other cases he must lie on the edge of the bed or sofa that the purse may freely hang down. If the hair on the pubes be too long, it must be shaved. The practitioner takes the testicle in one hand, separating it from the sound one, while with the other he somewhat stretches the skin of the scrotum. The spermatic cord is also in like manner to be separated. If the testicle be very much swollen an assistant must hold it, otherwise it is sufficient for the patient himself to separate the healthy from the diseased testicle. The first strip of sticking plaster is to be applied upon the isolated spermatic cord an inch above the testicle, the end of the strip is to be held with the thumb whilst a circular band is applied round the cord. In the same manner a second strip is to be put on, which should partially cover the first. This act of compression must be carefully made, the sticking

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(*a*) Ueber die Behandlung der Hodenentzündung durch compression; in Hamburger Zeitschrift für die gesammte Medicin, vol. i. part i.

plaster must closely envelop the cord, so that the testicle, especially if compressed at its lower end, cannot slip up through the loop which has been made towards the abdominal ring. The application of the sticking plaster is to be continued downwards to the bottom of the testicle in such way that each new turn overlaps one third of the breadth of the preceding one. Having reached the part of the swelling which has the largest girth, and where it gradually diminishes towards the base, the sticking plaster must no longer be applied circularly; the left hand must now grasp the part where the first strip was applied, and apply other strips, that, beginning from the upper part, they may be stretched in the long diameter of the testicle over the bottom and the other end attached behind. So many strips are to be applied in this direction that every part of the purse is covered, and the testicle enclosed and compressed in every direction. The application over the testicle must not be too tight. If both testicles are swollen, the compression must be applied as above described on one; there will not, however, be sufficient room for the circular straps to be applied separately on the other; they must, therefore, be so arranged that the previously compressed testicle should be enclosed with the other, and that thus strips of plaster should be carried around both testicles, the former serving as the point of support for the other. The strips from before to behind should be applied as already stated.

[I do not either approve or practise this mode of applying the plaster, but always commence from the bottom of the testicle, and pass upwards. It is rather more difficult; but if the skin of the purse be made tight over the testicle, as in operating for hydrocele, there is little awkwardness in applying the first few strips of plaster, and the rest follow with ease. Also as regards binding up the second testicle, if swollen, against that first compressed, I have not found much need to do so. The plasters will not fit very well at the first application; but, generally at the second, the pressure yields quite sufficiently for the perfect adjustment of the compression on each single testicle.—J. F. S.]

178. The patient can generally leave his bed immediately after the plaster has been put on; if the inflammation be not very severe, or, if just commencing, he may even go about. The reapplication of the bandage, if once be insufficient, should only be made when the sticking plaster has become so loose that the scissors can be introduced under it to divide it. If in patients with irritable skin the plaster causes excoriations, little notches must be made, and GOULARD's wash applied over it.

[I have not found once nor twice sufficient for the reapplication of the compressing straps, but they need putting on afresh for several days. The diminution of the bulk of the testicle at each visit, till it reverts to its natural size, is often very remarkable.—J. F. S.]

[*Metastasis of Gonorrhœa and Inflamed Testicle to the Brain.*

In speaking of Mumps it was mentioned that metastasis of that disorder sometimes occurred to the testicle or breast: and, I think, I am able to show that from gonorrhœa, and swelled testicle consequent on it, a metastasis may also take place to the brain, as in the following

CASE.—G. C., aged 31 years, a gardener, of healthy appearance, with a slight drawing up of the left corner of his mouth, was admitted into St. Thomas's, under my care, *Oct.* 22, 1844. He states, that during infancy he was subject to fits, whence ensued the drawing up of his mouth, as at present existing; but his health has been good up to two years since, when, whilst walking, he suddenly became giddy and insensible, and was told he was convulsed. He remembers he had then violent head-ache, and that he was cupped, blistered, and bled repeatedly, and under medical treatment for two months or more. Last June he had another attack of severe head-ache, and was relieved by cupping and purging; but he has since been subject to swimming in the head, with dread of falling.

About six weeks since he was attacked with a thick glutinous discharge from the urethra, which he cannot ascribe to a recent cause, not having had any connexion for a long while. The discharge continued pretty copious till within the last three days, when it diminished considerably, and the left testicle began to swell: it is now twice as large as natural, flattened, and very painful. I ordered him a dose of rhubarb and calomel, and the testicle to be strapped.

Oct. 26. The size of the testicle much reduced, and the strapping therefore to be reapplied. The discharge has rather increased.

Oct. 29. In consequence of the continued increase of the discharge, an injection of nitrate of silver, three grains to a pint of water, was ordered, by the use of which, in the course of a few days, the discharge was lessened.

Nov. 9. The testicle has returned to its natural size. He is complaining of headache, and feels swimming and giddiness.

Nov. 12. Has violent pain across the temples; pupils dilated and fixed, and vision dimmed; hearing very acute and he is much disturbed by the slightest noise; pulse 80, full and very incompressible; tongue white; bowels soluble; urethral discharge lessened. ℞ *pil. col. c. cal.* gr.x. *stat., c. c. ad* ℥xij. *nuchæ et empl. lytt. postea adhib.*

Nov. 14. Has not slept for the last two nights; mouth more drawn up since yesterday than heretofore; hearing very acute; vision more dim. The shooting pain across the forehead is more severe, and comes on every ten minutes in paroxysms; is perfectly sensible, and answers without hesitation; bowels confined. Discharge from the urethra *entirely stopped.* ℞ *pulv. rhei. c. hydr.* ℈j.; *hirud.* xij. *temp.*

Nov. 15. Mouth more drawn; head symptoms as last reported; pulse 108, softer; bowels open: complains of nausea. ℞ *hydr. chlorid.* gr.ij., *ant. potass. tart.* gr.½. 6*tis.*; *hirud.* xij. *temp.*

Nov. 17. This afternoon he had an attack of violent pain in the belly, with tenderness on pressure; pulse 108 and feeble. He was put in the hot bath, and a mustard poultice applied to the belly, by which he was relieved. But in the evening he had violent spasmodic pain, and it was found his bowels had not been relieved for the last three days. ℞ *ol. ricini* ℥ss., *tinct. opii* ♏xx. *stat.* This relieved him of the pain in the belly in the course of an hour or two. The head symptoms still continuing, a blister was applied to the nape of the neck.

Nov. 18. Had no sleep last night, but was quiet; and has had this morning about half an hour's sleep, the first he has had (according to his own account) since the 12th ult. Pain in the head violent as ever; pupils fixed and eyes vacant; pulse 108, feeble, sharp, but soft; tongue brownish; bowels open.

Nov. 19. Still most violent head-ache, and complains of pain in the belly. Put into a slipper bath immediately, which much relieved him; his head to be shaved, and cold lotions to be applied. ℞ *tinct. rhei* ʒiv., *tinct. op.* ♏xx. *ex aquâ menthæ piper.*

Nov. 20. His head aches much less: the pupils contract sluggishly on the application of light; pulse 108, feeble; bowels freely opened.

Nov. 21. Slept well last night; has less head-ache, but the pupils still continue sluggish; the countenance is less anxious; pulse 84, softer.

Nov. 22. His mouth having now began to be affected with the mercury, and his symptoms being improved, the pill was direeted to be taken at night only.

Nov. 29. Has continued mending; the head-ache has ceased, and his mouth has now reverted to its usual drawing up, the medicine was therefore left off. A gleety discharge from the urethra has re-appeared.

Dec. Left the house quite well. The discharge has gradually subsided without any treatment.—J. F. S.]

179. The proper application of the plaster requires great care; I have observed injurious effects from compression, in the practice abroad, by inattention to this circumstance. The advantages of this mode of treatment are, according to FRICKE's numerous observations, quick subsidence of the pain, a more rapid cure of the disease, simplicity, cheapness, and little want of attendance.

VI.—OF INFLAMMATION OF THE LUMBAR MUSCLES.

Ludwig, Diss. de Abscessu Latente. Lipsiæ, 1758.

Pott, Percivall, On the Palsy of the Lower Limbs; in his Chirurgical Works, vol iii. London, 1783. 8vo.

Pearson, John, Principle of Surgery, &c. London, 1788. 8vo.

Meckel, Diss. de Psoitide. Hallæ, 1796

Kirkland, Thomas, M.D., An Enquiry into the present state of Medical Surgery, vol. ii. London, 1783. 2 vols. 8vo. And Appendix to the same. London, 1813. 8vo.

Abernethy, J., Surgical Observations on Chronic and Lumbar Abscesses; in his Surgical Works, 2nd Edit., London, 1815, vol. ii. p. 137.

Cooper, Astley, On Psoas and Lumbar Abscess Surgical Lectures; in Lancet, 1824, vol. ii.

Lawrence, William, On Chronic Abscess; in Surgical Lectures in Lancet, 1830, vol. i.

Dupuytren, Article *De la Carie de la Colonne Vertébrale*; in his Leçons Orales, vol. i.

180. *Inflammation of the Lumbar Muscles* (*Lumbago*, *Psoitis*, Lat.; *Entzündung der Lendenmuskeln*, Germ.; *Inflammation des Muscles Lombaires*, Fr.) is situated in the *musculus psoas* and *m. quadratus lumborum*, and in the surrounding cellular tissue (1).

It sometimes occurs suddenly; the patient feels pain in the loins; walking becomes troublesome; the thighs can be neither raised nor completely extended without pain. Sometimes it commences gradually, with pricking pain, which, becoming more severe, spreads into the hip and thigh to the knee-joint. Not unfrequently the course of the inflammation is so insidious that it is scarcely noticed, and the disease is first shown by the collection of pus. According to the degree of the inflammation does suppuration occur early or late. The pus collects in the cellular tissue surrounding the *psoas* muscle, descends in its course, and a swelling is produced beneath Poupart's ligament, in the neighbourhood of the rectum, upon the spine, and so on. During these collections of matter, the patient suffers pain in the loins; walking is troublesome, a movement of the pus contained in the swelling is felt on coughing; the swelling is smaller when in the recumbent posture; at first the skin is unchanged. The general symptoms of suppuration, as emaciation, night sweats, hectic fever, and so on, rarely occur when the extent of the abscess is not large. But if, during its increase, the skin covering it inflame and break, pus is discharged at first without smell, but subsequently stinking, and the powers of the patient are quickly exhausted, or the aperture draws together and remains fistulous for a long time.

[(1) It must be distinctly understood that the disease now under consideration, is not that we usually call "Lumbago," which consists of a rheumatic inflammation of the lumbar fascia, but the complaint which we know as "Psoas or Lumbar Abscess;" and, as will be presently seen, it is almost always a secondary disease, a disease *in* the part, and not *of* the part, as Hunter calls such, resulting from affection of the vertebræ, and would be more in place if considered with diseases of joints, under the head "Inflammation of the Vertebral Joints." (*par.* 257 and following.)—J. F. S.

Astley Cooper says of this disease:—"You may know this abscess by the following marks:—in the first place, when you ask the patient whether he has for a long time had continued pains in the loins; if he has psoas abscess, he will reply 'yes; four, five, or six months;' you will find that he has a difficulty in extending the thigh if he puts his legs together, he feels pain and tightness in the groin, and has increased pain in attempting to exert the limb, in consequence of the psoas muscle being then on the stretch." (p. 460.)

Pearson remarks, that "during the progress of suppuration, as there is a remission of the more severe symptoms, the patient often imagines that he is recovering his health; some degree of pain, however, and an inability of duly performing the motion of the parts always remain. He is, sooner or later, alarmed by the appearance of a soft tumor, which arises in one or more of the parts enumerated above. At the first it is rarely accompanied with any discoloration of the integuments or pain, unless it be compressed. When the person stands erect, the tumour becomes more prominent; but its contents recede, either in whole or in part, when he assumes a horizontal posture." He also notices, that "if the contents of the abscess be included in a firm cyst, the long continued pressure of so large a body upon the lumbar vertebræ will sometimes induce a paralysis of the lower extremities." (pp. 97–9.)]

181. The causes of this inflammation may be external violence, severe strains, catching cold, rheumatism, gout, dyscratic affections of all kinds. Caries of the lumbar vertebræ very frequently accompanies lumbar abscess, of which it may be cause or consequence.

[The cause of this disease is held by English surgeons in general to be disease of the vertebræ. This seems to have been first noticed by **Pott**, who, in speaking of the complaint which arises from what is commonly called "strumous or scrofulous indisposition affecting the parts composing the spine," says, that "sometimes it is found in the form of bags or cysts, containing a quantity of stuff of very unequal consistence, partly purulent, partly sanious, and partly a curd-like kind of substance; and not unfrequently entirely of the last. Sometimes, under these bags or cysts, even while they remain whole, the subjacent bones are found to be distempered, that is, deprived of periosteum, and tending to become carious." And then he comes to the disease now considered:—"Sometimes these collections erode the containing membranes, and make their way down by the side of the psoas muscle toward the groin, or by the side of the pelvis behind the great trochanter, or, in some cases, to the outside of the upper part of the thigh." (pp. 467, 8.)

Astley Cooper describes it as "very often nothing more than an abscess, from the disease of the intervertebral substance which I have just spoken of, having its origin in inflammation of the spine and the intervertebral substance. The matter spreads till it reaches the origin of the psoas muscle, which passes into ulceration, and forms a bag, surrounded by a complete ring. The abscess proceeds as far as the tendon of the muscle, by **Poupart's** ligament, and its further progress is restrained by the tendon; when it passes under **Poupart's** ligament, between the femoral vein and the *symphysis pubis*, it has generally attained considerable magnitude, and has the appearance of femoral hernia. * * * If the abscess form on the side of the vertebræ, instead of the fore part, it is termed lumbar abscess instead of psoas." (p. 460.)

Abernethy says:—"Lumbar abscesses in general descend along the psoas muscle, under **Poupart's** ligament;" they "also, in general, are not simple diseases; they arise from and communicate with carious vertebræ; which circumstance is, I believe, the cause of their frequent fatality. The first eight cases that I attended, after I had adopted a new mode of opening them, were simple abscesses, and not arising from disease of the bone, which led me to believe that they were more frequently unconnected with diseased bone than later experience has taught me. The general opinion of Surgeons, in which I entirely concur, is, that lumbar abscesses most frequently arise in consequence of diseases of the vertebræ, and they should certainly all be treated as if such was their origin;" (p. 143.) "as," he afterwards observes, "we cannot know whether the bone be diseased or not." (p. 159.)

Lawrence speaks of "the chronic abscess termed *psoas* or *lumbar abscess*, where, in consequence of the disease of the vertebræ of the lower portion of the back or loins, matter forms around that diseased part, and then descends through the loose cellular membrane covering the muscles along the side of the pelvis into the thigh; it may take a course towards the back, or may go in various directions either within or on the outside of the pelvis." (p. 396.)

Dupuytren says:—"Caries having been once established, the pus remains for a longer or shorter time in the carious spot, in the parts surrounding it, and especially in the cellular tissue. It forms at first a cyst where the pus collects. As the quantity of pus increases the cyst descends; lengthens as it inclines to one or other side of the spinal column, or to both sides at once; the pus makes its way, pushing before it the lower end of the cyst; if it meet with any obstacle it spreads out, but contracts when pressed on by the neighbouring parts, and dilates again when relieved from the pressure. Having arrived beneath the skin, after a more or less lengthy course, the pus projects, and causes a swelling which terminates by forming an abscess. This purulent collection, known by the name of *congestive abscess*, but more properly called *symptomatic abscess*, is a very serious disease, and generally considered fatal." (pp. 136, 7.)

The disease may and frequently does arise from external violence, blows, strains, or the like; but its commencement is in the spine, whence it is propagated to the muscles, which, however, are in fact only absorbed to form a route for the matter produced by the diseased vertebræ to escape.]

Inflammation and suppuration in the psoas muscle, or in the lumbar mass of muscles, without disease of the spine, is rare, and more especially in the former. Of the nineteen cases given by Abernethy, only two are mentioned in which there was no actual disease of spine.—J. F. S.]

[181*. Psoas abscess, when protruding below Poupart's ligament, may, on account of having the same seat as femoral hernia, be mistaken for that disease, especially as it dilates on coughing, and to a certain degree returns into the belly when the patient lies down. But it is generally of larger size, of greater breadth than femoral rupture, and the fingers cannot be at all thrust behind it, as they can be partially behind the hernial sac. The principle distinction, however, is the long continuance of pain in the loins previous to its appearance, and which, indeed, still continues: and the pain produced by attempting to extend the thigh backwards upon the pelvis, and which can only be effected to a limited extent. When the abscess appears in the loins there is no difficulty in determining its character by its history and by its dilatation on coughing. Pulsation may sometimes be communicated to it from the neighbouring large vessels, and under such circumstances it has been mistaken for aneurism.—J. F. S.

John Pearson well observes:—"The situation of the external abscess is not uniform; most commonly it is at some distance from the original seat of the disease; nor is the point at which it projects forward to be considered as forming a portion of the abscess. The fluctuation of the matter may therefore be mos tpalpable about the loins, or at the hip, in the groin, or near the rectum, and sometimes it points towards the lower part of the thigh, in the direction of the large blood vessels." (pp. 96, 7.) "As the purulent matter is situated behind the peritoneum, and the erect position of the body is favourable to its progression downwards, we do not often meet with instances where it is effused into the cavity of the abdomen." (pp. 98, 9.)

Samuel Cooper (*a*) mentions a remarkable case of lumbar abscess, under the care of Ramsden, in which "the tumour extended, from the ilium and sacrum below, as high as the ribs; its diameter, from behind forwards, might be about six or eight inches; it was attended with so strong a pulsation, corresponding with that of the arteries, that it was considered to be a case of aneurism of the aorta. After some weeks, as the tumour increased in size, the throbbing of the whole swelling gradually became fainter and fainter, and at length could not be felt at all. The tumour was nearly on the point of bursting, and Ramsden, suspecting that it was an abscess, determined to make a small puncture in it; and a large quantity of pus was evacuated at intervals." (p. 944.)]

182. The dispersion of the inflammation of the lumbar muscles would be in most instances possible, were not the symptoms often at first so slight as to be usually neglected. The *Cure* is directed by the degree of the inflammation and its causes. In severe inflammation the antiphlogistic treatment is properly adopted, blood-letting, the application of leeches or cupping-glasses. As the inflammation diminishes, the resolution is to be encouraged by volatile ointments and perpetual blisters. If the cause be rheumatism or gout, and the inflammation be insidious, solution of acetate of ammonia in infusion of elder flowers, antimonial wine in small doses, Dover's powder, camphor and the like, may be given; but especially warm baths, rubbing in volatile ointments, blisters, and issues, are to be used.

(*a*) Surgical Dictionary,—Article, *Lumbar Abscess.*

[The reason assigned by Chelius for the neglect of the primary symptoms of this disease is hardly carried far enough, as, in reality, the attack comes on so slowly and insidiously that the patient is scarcely aware of having anything more than slight rheumatic or "growing pains," as young people call them, till some trifling occurrence brings him to a stand-still, and the serious character of his disorder is almost accidentally discovered, often, indeed, not before it has proceeded to suppuration.—J. F. S.]

183. When the inflammation terminates in suppuration, and swellings are formed by the descent of the pus, such abscesses, even when they have obtained a considerable size, may, in some cases, although rarely, be dispersed, by perpetual blisters or issues on the loins, by general treatment which puts the abdominal functions in order and strengthens the patient's powers (1). But if, under this treatment, the abscess increase, it must be opened with a lancet, which should be introduced obliquely (2). The pus must be discharged, as far as possible, in an unbroken stream. The wound is to be carefully closed with sticking plaster, a compress is to be laid over it, the patient kept quiet, and the above-mentioned treatment employed. The wound usually closes in a few days; but the pus most commonly recollects, though in less quantity than at first. If the swelling again rise sufficiently high, it must be again emptied as before, and this must be repeated as often as the abscess is reformed. If the abscess be originally of no great size, or diminished by repeated punctures, it is often best to treat it as a common abscess, to open it freely, and simply apply a poultice; at the same time, however, supporting the powers by tonic remedies, and by a proper dietetic regimen.

[(1) Dupuytren observes, that "these abscesses remain sometimes in the same state for years, and without causing any symptoms; the pus is gradually absorbed and no trace of them remains. At other times, after a greater or less interval, the skin covering them inflames, bursts, and gives issue to the pus, which drains away and is not reproduced. In other circumstances, the pus, having remained for a longer or shorter time, is converted into an adipocerous matter: chemical experiments have proved, indeed, that such is the nature of the substance sometimes met with in abscesses of this kind." (p. 138.)

Astley Cooper has made the following observation in regard to the treatment of this disease:—"You must allow the abscess to take its course; very little can be done in this disease until it has acquired considerable magnitude." (p. 460.) This recommendation is very unsatisfactory; for the treatment should be commenced so soon as the existence of the disease can be ascertained with any certainty, so far, at least, as the use of counter irritants is concerned; for I cannot agree with Cooper that "little can be done to prevent its progress when once formed, and I do not know that any advantage is to be derived from counter irritation." (p. 461.) I feel sure, on the contrary, that much may be done, and, believing that caries of the vertebræ is always the origin of the disease, the treatment which it requires is that which at the onset is necessary for lumbar or psoas abscess, and which, indeed, must be persevered in, even after the abscess has either burst or been punctured; I mean the use of issues.—J. F. S.

Various expedients have been proposed for exciting the absorbents to take up the pus. "The elder Cline (*a*) once gave digitalis to a very considerable extent to a boy of fourteen or fifteen years old; the abscess diminished for a little time, but when the digitalis was given up, in consequence of its influence on the general health, the disease returned." (p. 461.) Abernethy has recommended the application of repeated blisters or of open blisters upon the swelling, and has given two cases under this treatment in which the pus was absorbed. I have not had any personal experience on this point, and cannot, therefore, say anything about it. The same distinguished surgeon has also advocated the use of electricity; but, as in all the cases in which he employed it, other remedies were also used, it is not possible to determine what benefit was attained by it. The exhibition of emetics, to which he also resorted, was under the same circumstances, and, therefore, much cannot be decidedly attributed to them.

Issues are most important aids in the successful treatment of psoas or lumbar abscess, either whilst the abscess remains unopen, or after an aperture in it has been self-formed or made artificially, by which the pus has escaped, and from which it long

(*a*) As stated by Astley Cooper.

continues to be discharged. I do not know any circumstance under which their employment should be withheld. The issue should not be made on the same side of the spine as that where the abscess is, if presenting in the loins, but on the other side, and opposite the outer margin of the *m. quadratus lumborum.* And, if there be abscess in both lumbar regions, the issues should be put in above and below them. But, if the swelling present in the top of the thigh, as in the psoas abscess specially so called, it may then be made on the same side, or, indeed, on both sides issues may be introduced. The issue should never be made upon the ridge of the spine, as, on account of the nearness of the spinous processes to the skin, the periosteum and ligaments covering their tips may be involved in the slough, and the processes themselves become necrotic. Neither should it be made over or upon the abscess itself, as the separation of the slough will open its cavity. Large issues I do not think advisable: a slough as large as a sixpence, made with caustic potash, will, when thrown off, leave a wound as big as a shilling, which is large enough to hold three or four glass beads, and amply sufficient, as with but little attention the issues can be kept open for a considerable time, and, when they seem disposed to heal, their surface must be smeared with the caustic potash sufficiently to produce a fresh slough, and, on its separation, the peas are to be again introduced. The intention of the issues is to divert the diseased action going on in the vertebral column, which is generally the cause of psoas or lumbar abscess, as already mentioned, and is a practice which I have found eminently successful.—J. F. S.

(2) Much difference of opinion still exists among surgeons as to the propriety of waiting the self-evacuation of these abscesses, or of puncturing and emptying them either entirely or partially.

Abernethy asks, when the abscess " protrudes the integuments, that they, from distension, become irritated; that their temperature is slightly augmented; what are we then to do? Are we to wait till evident signs of inflammation appear? I think not. I would relieve them from distension, by emptying the abscess through a wound made by an abscess lancet. I would open the abscess for a reason which appears paradoxical on its first proposal, which is that it may be kept closed. We can empty a cavity, and by healing the wound keep it afterwards shut, and no inflammation ensues. If nature opens the cavity by ulceration, the opening is permanent and the inflammation consequent must be endured." (p. 153.)

The practice of puncturing large abscesses with a trocar, seems to have been first advised by Deckers, in 1696; he left the canula in the cavity stopped with a cork, and let out the matter at intervals. The same proceeding was also adopted by Benjamin Bell. Tapping these abscesses with a small trocar was also recommended by Crowther, who always introduced it at the same spot. He thought that the aperture so made did not ulcerate, nor allow the matter to escape after being dressed. In addition to drawing off the pus with a trocar, Latta (*a*) advises, that after this is effected, the end of the canula, which had been introduced at the bottom, should be pressed gently up to the top of the abscess, the trocar introduced into it and thrust through the skin, and then, being withdrawn, a skein of silk to be passed through the canula, which is also to be removed, and thus a seton formed. (p. 36.) The introduction of the seton is, I should consider, a very dangerous experiment, as likely to excite inflammation, always too much to be dreaded, in a part too prone to run into that condition. I have never pursued this practice, nor, for the reason just mentioned, should I be disposed to do so. And, as to puncturing with the trocar, I do not see any advantage to be obtained from it, and certainly cannot believe the wound would heal more speedily than a simple puncture with a lancet.—J. F. S.

Abernethy's peculiar treatment consisted in puncturing with " an abscess lancet introduced with very little obliquity so far that the wound of the cyst of the abscess should be half an inch in length, and that of the integuments, of course, a little longer. A wound of that size is generally sufficient to give discharge to the solid flakes which will occasionally block up the opening without much poking. It is necessary that the flow of matter should be uninterrupted, so that no air should gain admittance; it is, therefore, right to make pressure on the abscess, in proportion as it is emptied. The abscess where it presents itself is emptied before that part of it in the loins is completely so. The surgeon should then press the sides of the wound together with his finger and thumb, so as to prevent the ingress of air, and desire the patient to cough repeatedly, which will impel the matter from the internal part of the abscess into that which is punctured. When the abscess is emptied as much as possible, the wound should be attentively wiped, and the edges placed in exact contact, and retained in that state by strips of plaster." (p. 154.) A compress is then put on, but no bandage; the patient is

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(*a*) Practical System of Surgery, vol. i.

to lie perfectly quiet, and the wound, being dressed every second day, "generally united by adhesion, though sometimes otherwise, for it may discharge a little, and yet unite firmly. The abscess thus treated is as free from inflammation as it was before it was punctured. The abscess will, however, fill again, and that sometimes even rapidly. In the first cases which I attended, I punctured pretty regularly after the expiration of a fortnight, and I found in general that the abscess contained about one-third less of fluid. * * * After having discharged the contents of the abscess three or four times, I found that it was not necessary, nor, indeed, easily practicable to puncture it at the end of the fortnight, because it was so little filled and prominent." (pp. 155, 6.)

ASTLEY COOPER supports ABERNETHY'S mode of treatment. He says:—"Let the abscess proceed until you observe a redness or blush of the skin, and then adopt Mr. ABERNETHY'S plan of making a valvular opening into the part, so as to discharge the matter, and close the wound almost immediately. The danger does not arise from the quantity of matter accumulated, but from the irritation produced by the attempts of nature to close the abscess and fill the cavity by the process of adhesion. Four days after the abscess is opened violent symptoms of constitutional irritation are apt to come on, such as great depression of strength, loss of appetite, and the patient is soon reduced to the lowest extremity. It is extremely desirable to prevent the occurrence of these symptoms, and the plan of Mr. ABERNETHY is the best that has ever been suggested by any Surgeon with a view of preventing them." (p. 461.)

LAWRENCE also advocates ABERNETHY'S practice, as it "gets rid of the continuance of an abscess of this kind without incurring the risk of the inconvenience" which arises when, "as in opening a phlegmonous abscess, an incision is made and the matter let run out, and then applying a poultice over it, the access of air into the abscess produces decomposition of the pus which it contains, the matter becomes fetid, the surface of the abscess is inflamed, and the secretion from its sides becomes exceedingly altered, thin, and stinking, extremely irritating to the portion which is in contact with it. The inflamed surface of the abscess is a source of sympathetic disturbance in other parts in the alimentary canal or in the vascular system, and thus arises fever of a different kind." (p. 396.)

Other writers, as KIRKLAND, prefer "the tumour being suffered to break of itself, and its contents to drain gently off, through a very small aperture, which prevents the free ingress of air and violent symptoms; for, when a large tumour of this sort forms on the inside of the thigh, and breaks in a large opening, in such a manner that the air has already passage, we frequently see a violent colliquative fever succeed, that closes the scene in a very short time. But, though small openings should be obtained if possible, they too seldom secure the patient." (p. 199.)

JOHN PEARSON observes on this point:—"Some of the older Surgeons, and the French Surgeons (of his time) in general, advise a free opening to be made, or the introduction of a seton. It hath been thought more advisable, by other practitioners, to permit the abscess to burst spontaneously. Several of the modern Surgeons recommend a very small aperture to be made, and the ulcer to be treated in a very gentle manner. My own experience is in favour of the last mode of treatment, and I have been so happy as to see it followed by a perfect cure of the disease." (p. 103.)

DUPUYTREN "considers it dangerous to open symptomatic abscesses, resulting from caries of the spine, which has yielded to treatment. So to proceed is to re-excite the principal malady, and to lose all the benefit of long and active treatment. He, therefore, recommends giving up these abscesses to the mere efforts of nature; and he follows the same practice even when all remedies have been unavailing to cure the caries." (p. 139.)

The practice I have pursued, which has been for many years past commonly followed at St. Thomas's Hospital, has been either to permit the abscess to break of itself, or only to puncture it when the skin has so reddened and thinned at one point that there is no chance of its bursting being avoided. The puncture should not be a large one, nor do I think making it valvular is of any consequence, as I make no effort to produce its union. It should be of sufficient size to permit the escape of the pus, which should flow out, if it may be so said, at the pleasure of the abscess, which should, on no account, be squeezed or kneaded, to empty its cavity. If thus left to itself the pus flows slowly and the sides of the abscess gradually fall together, though without at once uniting, and accommodate themselves to their new condition, so that ultimately the original abscess becomes only a more or less capacious sinuous cavity, which, if the disease originate in the spine, gives vent to the pus there formed, and may itself also, for a longer or shorter time, furnish the discharge. I have not generally observed the hectic symptoms which by some Surgeons are described as almost certainly occurring when large abscesses, bursting or being opened, at once empty themselves; and I apprehend that when the sac inflames and hectic fever comes on, the cause is rather in the irritable state of the constitution than in the emptying of the abscess. I am not prepared to say, nor would I advise a large puncture and the immediate emptying of the abscess; but, from repeated observation of the practice of others, corresponding to my own above described, viz., the gradual evacuation, either by bursting or by a moderately large puncture, I am convinced that this plan of proceedings is the best.—J. F. S.

The issues are to be still kept up, even after the puncture has been made, for the purpose of diverting the original disease, as already mentioned; and this practice is in accordance with **Abernethy**'s recommendation, that "an issue should be made in the loins, which is likely to be beneficial by its counter-irritation, even when the abscess is not connected with diseased bone; but, when it is, then an issue will be more serviceable and necessary." (p. 151.)

As regards injecting the sinuous cavities into which, after a time, these abscesses are converted, **Pearson** states, that "some of the older writers forbid the use of injections in the lumbar abscess; but their reasons seem to be founded upon mistaken ideas of the true situation of the disease. Solutions of copper, vitriol, or even tepid sea water may sometimes be applied in this way with considerable advantage." (pp. 103, 4.) **Astley Cooper** also says, he "has seen benefit from injecting the abscess, (I presume when it has become fistulous,—J. F. S.): the injection usually employed is the sulphate of zinc or alumen; it promotes the adhesive process in the interior of the abscess, glues its sides together, and lessens the purulent secretion." (p. 461.) **Dupuytren** states "that cauterization may be employed advantageously; but the actual cautery must be straight and exactly run through the canal. In other cases it may be convenient to have recourse to injections of nitrate of silver, or of nitric acid, largely diluted with water, taking care that these liquids do not escape in their course. For these injections he employs twenty or thirty grains, or a drachm of nitrate of silver to a pint of distilled water, and injects it with a siphonous syringe." (p. 148.)

184. There is danger when the cavity of the abscess inflames after the discharge of the pus; and attempts must be made to diminish the inflammation by quiet, by suitable antiphlogistic treatment, and by discharge of the pus. If symptoms of hectic fever are indicated, or the opening of the abscess become fistulous, (the cause of which may be some internal process still going on, such as caries of the lumbar vertebræ or thickening of the walls of the abscess,) the powers of the patient must be supported as much as possible, and, if a general cause can be found out, we must endeavour to counteract it.

[When the cavity of the abscess is inflamed it is known by the great pain caused by slight pressure on the surface, and by the escape of a thin, fetid, frothy matter from the aperture, whether made by ulceration or artificially. It is generally accompanied by the hectic symptoms; but, sometimes, **Abernethy** observes, "both the local and constitutional diseases are of a more purely inflammatory kind;" under which circumstance, the above-mentioned discharge and the hectic symptoms are deficient. Sometimes "the fever is at first inflammatory, then hectical, and, when the local complaint becomes indolent, the general state of the patient's health is no longer affected." And **Abernethy** says, he has "known a considerable space of time elapse between the first bursting of a lumbar abscess and its assuming that morbid state which is so peculiar to those diseases, and which produces a corresponding affection of the system in general." (pp. 221, 2.)

In conclusion, it is right to mention the important observation made by **Pearson**, that, "although the larger arteries have been known to be surrounded with purulent matter for a considerable length of time without suffering any injury, yet this is not universally the case; there have occurred many instances where erosion has taken place, and the person has been suddenly destroyed with hæmorrhage." (pp. 99, 100.) **M'Dowell** (*a*), however, mentions a case in which "ulceration took place in a portion of the ilium adhering to the cyst of the abscess: and the contents of the bowel, after having passed into the abscess, escaped through a fistulous opening near the spine of the ileum. Ulceration also of the external iliac artery followed about an inch and a half above **Poupart**'s ligament, and sudden death resulted from the blood escaping in large quantities into the cavity of the abscess." (pp. 912.)]

(*a*) In Dublin Journal of Medical Science, vol. iv.

VII.—OF INFLAMMATION OF THE NAIL-JOINT, OR WHITLOW.

Garengeot, Traité des Opérations de Chirurgie. Paris, 1720, 8vo. Vol. III.—Translated as, A Treatise of Chirurgical Operations, according to the Mechanism of the Parts of the Human Body. London, 1723. 8vo.

Le Dran, Hen. Fr., Traité des Opérations de Chirurgie. Paris, 1742. 8vo.—Translated as, The Operations in Surgery of Monsieur **Le Dran**, by Mr. **Gataker**. 3rd. Edit. London, 1757. 8vo.

Focke, Diss. de Panaritio. Götting., 1786.

Melchior, Diss. de Panaritio. Duisb., 1789.

Flajani, Osservazioni Pratiche sopra il Panereccio. Roma, 1791. 8vo.

Vogt, Diss. de Paronychia. Viteb., 1803.

Sue, P., Réflexions et Observations Pratiques sur le Panaris ; in Recueil des Mémoires de la Société Médicale d'Emulation de Paris, vol. ii.

Wardrop, J., An Account of some Diseases of the Toes and Fingers; with Observations on their Treatment; in Med.-Chir. Trans., vol. v. p. 129.

Duteil, Dissertation sur la Panaris. Paris, 1815.

Craigie, D., Pathological and Practical Observations on Whitlow, in the Edinburgh Med. and Surg. Journal, April, 1828, p. 255.

185. *Whitlow*, or *Inflammation of the Nail-Joint of the Fingers and Toes*, (*Panaritium*, *Onychia*, *Paronychia*, Lat. ; *Umlauf*, *Wurm*, Germ. ; *Inflammation des Doigts*, *Panaris*, Fr.,) according to its seat and the consequent variations of its severity, usually presents itself in the following four degrees :—

[The following mode of deriving the term whitlow, as given by **Beckett** (*a*), is interesting :—" The old English word *hawe* signifies a swelling of any part. Thus, for instance, a little swelling on the cornea, was anciently called the *hawe in the eye ;* and the swelling that frequently happens on the finger, on one side the nail, was called *whitehawe*, and afterwards *whitflaw* or *whitlow*." (p. 52.)

The division of whitlows employed by **Chelius** was first proposed by **Garengeot**, and is generally followed; but, excepting the first species, which is well marked, I am rather disposed to agree with **Gibson** (*b*), that " these varieties, however, are in a great measure arbitrary; for it is not always in the power of any surgeon to declare from examination of the part, what particular texture is affected." (p. 186.)—J. F. S.]

First. If the inflammation be entirely superficial at the root or side of the nail, the pain is not great; the swelling does not spread beyond the first joint of the finger, but quickly passes to the outpouring of a purulent matter which lies immediately beneath the skin, and assumes a bluish colour; the pain only becomes severe when pus has collected beneath the nail, which generally falls off, and a new one soon grows.

[This whitlow is **Abernethy**'s *Paronychia ungualis*. It begins with slight inflammation, accompanied with a throbbing, and by degrees raises up a small white semi-transparent bladder, the whiteness of which depends on the thickness and opacity of the cuticle. It seems, as **Le Dran** says, to be " only a disease of the skin, which, being slightly excoriated or irritated from some external cause, inflames, and is followed by a collection of purulent serum between the cuticle and true skin." (p. 413 ; Fr. edit., p.539.)]

If the whitlow be left without puncture, it continues increasing, stripping the cuticle of the true skin, and distending it more and more, till at last, finding a crack or a thin part, it bursts, and the pus is discharged But the continued pressure has ulcerated the cutis and then, as **John Hunter** observes, " the soft parts underneath push out through the opening in the cuticle, like a fungus, which, when irritated from any accident, give a greater idea of soreness, perhaps, than any other morbid part of the machine ever does. This is owing to the surrounding belts of cuticle not having given way to the increase of the parts underneath, by which means they are squeezed out of this small opening, like paint out of a bladder." (p. 470.)

(*a*) Phil. Trans., 1720, vol. xxxi.

(*b*) Institutes and Practice of Surgery, vol. i.

Hunter gives the following reasons (the correctness of which must be readily admitted) why the abscesses "about the nails, commonly called whitlows, more especially in working people, give so much pain in the time of inflammation, and are so long in breaking, even after the matter has got through the cutis to the cuticle; the thickness of the cuticle, as also the rigidity of the nail, acting in those cases like a tight bandage, which does not allow them to swell or give way to the extravasation; for in the cuticle there is not the relaxing power, which adds considerably to the pain arising from the inflammation; but when the abscess has reached to this thick cuticle it has not the power of irritation, and therefore acts only by distension; and this is, in most cases, so considerable as to produce a separation of the cuticle from the cutis for a considerable way round the abscess." (p. 469.) * * * "All of which circumstances taken together, make these complaints much more painful than a similar-sized abscess in any of the soft parts." (p. 469.)]

Second. When the inflammation is situated in the cellular tissue beneath the skin, and commonly at the bulbous end of the finger, the pain is very severe on account of the tension of the thickened skin. If the inflammation pass into suppuration, fluctuation cannot readily be perceived, and the pus makes itself an outlet with difficulty.

[This form might not inaptly be called *Paronychia cellulosa*, as, in the inflamed cellular tissue of other parts, the inflammation is disposed to spread; the whole finger often becomes affected, and the disease occasionally extends into the hand itself. The severity of the pain is great, because, as **Le Dran** observes, "the skin of the finger is of very close texture, and therefore cannot yield to the increased size of the inflamed parts which it encloses, consequently the tension, pain, and fever are more violent." (p. 414; Fr. edit. p. 542.)]

Third. If the inflammation be situated in the *sheaths* of the tendons, the pain, which is specially situated on the front of the finger, is very severe, and strikes up through the whole arm to the shoulder; upon the finger only a slight swelling is to be observed, but it spreads so much the more over the greater part of the hand to the wrist, and even to the fore arm. Severe fever usually accompanies it. If the thumb, fore, or middle finger be attacked, the pain ascends outwards upon the front of the hand; but, if the ring or little finger be attacked, then the pain is continued along the ulnar surface to the elbow-joint and up to the arm-pit. When suppuration occurs, fluctuation is not distinguishable on account of the deep situation of the pus. The inflammation readily spreads to the periosteum, and destruction of the phalanges often ensues.

[This form is **Abernethy's** *Paronychia tendinosa.*

Travers (*a*) observes that "this, the case of acute paronychia," as he calls it, "is frequently accompanied with absorbent inflammation, but not invariably; nor is it on this account more serious. Matter is secreted by the inflamed synovial surface of the tendinous sheath, or the particular fascia investing the tendinous extremity of a muscle of the arm or leg; or beneath a ligamentous expansion, as the palmar or plantar aponeurosis." Sometimes the symptoms supervene in a few hours after the injury, sometimes not for days, so that the patient scarcely recognises the injury, usually a small penetrating wound. If the wounded thumb or finger is disfigured by excessive œdema, the symptoms of disturbance are less severe than when, with great tension, the swelling is inconsiderable and void of fluctuation, so as to make the existence of matter doubtful. The quantity of pus is so small, and the relief of discharging it so great, as to demonstrate that its situation alone had given rise to the intense pain. Is it owing to the partial escape of matter into the cellular substance, or to the inflammation having originally attacked this texture, exterior to the theca or fascia, and affected the interior only by sympathetic connexion, that the symptoms are less urgent when the œdema is present?" (pp. 216, 17.)

Le Dran considers this form of whitlow to differ from the preceding in not being consequent on phlegmonous but erysipelatous inflammation: and he does "not think that an erysipelas affecting these parts, and forming a whitlow can proceed from an in-

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(*a*) On Constitutional Irritation, part i.

ternal cause, as other tendons are not found subject to this disorder: but it may be owing to a puncture which has affected the tendon, together with the sheath, or even the sheath alone. These two parts, we know, are blended together at the third joint where the tendon is inserted into the bone: it is therefore no wonder if inflammation of the one should extend to the other. The inflammation spreads afterwards all over the hand and along the muscle from which the tendon arises, as far as to the fore arm, sometimes even to the whole arm, forming an erysipelatous inflation, which terminates under the arm-pit, and swells the axillary glands. The pain and fever are then very violent, attended sometimes with delirium and convulsions." (p. 419; Fr. edit., p. 547.)

This tendinous and the cellular whitlow just described are continally running one into the other from continuous sympathy; and, under one or other form, or a compound of both, often appears the result of punctured wounds, (which will be heareafter considered, *par.* 328.) especially those most dangerous and often fatal received during dissection. The inflammation set up in the tendon or its sheath, and propagated from the one to the other, as described by Le Dran, is always accompanied with inflammation of the neighbouring cellular tissue, and, as Chelius observes, often spreads to the periosteum, which, separating from the bone in consequence of the effusion of matter beneath it, and often participating in the slough of the theca and tendon, which not unfrequently, though not so constantly, happens in this disease, that we can agree in Le Dran's definition, that it is "not a phlegmonous abscess, like the second kind, but a putrefaction either of the sheath alone or the tendon with it." Under these circumstances, the bone is destroyed and exfoliates, which is commonly a very tedious though not dangerous process.—J. F. S.]

Fourth. On the inflammation taking place in the periosteum; the pain is excessively severe, though not spreading over the hand and fore arm; the affected finger at the beginning is not at all swollen; it soon suppurates, and the bone is attacked.

The severe kinds of whitlow may be connected with each other inasmuch as a less may pass into a more severe form. In the spreading of the inflammation over the hand, painful swellings may occur in various parts.

A painful state, near the nail of the little finger, without any previously apparent inflammation, has been observed, which Richter calls the *dry whitlow*, in which the pain continues for minutes or hours, and then disappears for days or weeks. On amputation of the finger all the soft parts are found natural, but the bone converted into a mass resembling fat (*a*).

[Abernethy calls this *Paronychia osseosa.*

Le Dran asserts "that this species of whitlow proceeds from a disease of the bone, in consequence of which the periosteum soon putrefies, or is attacked with an erysipelas which degenerates into a putrefaction: from whence it happens that, when making an opening, the bone is found bare and frequently carious." He observes that "the inflammation seldom extends over the fore arm, as described in the preceding kind." (p. 420; Fr. edit., p. 550.)

I do not recollect to have distinguished this disease, and doubt much whether the indications mentioned are sufficient for that purpose.—J. F. S.

Abernethy speaks of "an ulceration with great thickening at the end of the fingers, and toes, and pain particularly at night, which has been described under the name of *Epinychia.* It goes on producing disease of the skin, and no nail will grow, or perhaps the disease extends and leaves a little island of nail, and this I have seen plucked out as the cause of the disease, though it was really the only sound part. I have seen it go on for three years and not get well. It is the produce of an ill state of health." (*b*). I presume under this name Abernethy refers to the disease called by Sauvages (*c*) *Epinyctis;* he describes it, however, as a pustule rising in the night, resembling a boil, of a blackish red colour, crowding together three or four lines in diameter, affecting chiefly the legs, and very frequently painful, especially at night. He describes two species,—*E. vulgaris,* and *E. pruriginosa.*

John Pearson speaks of a *Venereal Paronychia,* which he describes as appearing in the form of a smooth, soft, unresisting tumour, of a dark red colour, and situated in the cellular membrane about the root of the nail. It is attended with an inconsiderable degree of pain in the incipient state; but, as suppuration advances, the pain increases in

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(*a*) Ackill, Chirurgische Vorfalle, Gott., 1777, vol. p. 210. (*b*) MS. Lectures on Surgery.
(*c*) Nosologia Methodica. Amsterdam, 1768. 4to. vol. i.

severity; its progress towards maturation is generally slow, and seldom completed. When the sordid matter it contains is evacuated, the nail is generally found to be loose, and a very foul, but exquisitely sensible ulcer, is exposed; considerable sloughs of cellular membrane, &c., are frequently exfoliated, so that the cavity of the sore is often very deep. The discoloured and tumid state of the skin commonly extends along the finger, considerably beyond the margin of the ulcer; in such cases, the integuments that envelop the finger become remarkably thickened, and the cellular membrane so firmly condensed as not to permit the skin to glide over the subjacent parts. The bone is not usually found in a carious state. This species of paronychia is more frequently seen among the lower class of people, when they labour under *lues venerea,* than in the higher ranks of life. It does not appear to be connected with any particular state of the disease, nor is it confined to one sex more than the other. In the Lock Hospital it occurs in the proportion of about one patient in five hundred." (pp. 85–7.) It is evident, however, that **Pearson** is not quite satisfied as to the actual nature of this disease, which seems more to resemble *onychia maligna* than any other form of whitlow; for he proceeds:—"When I adopt the name of venereal paronychia, it is not with the design of *implying that this is a true venereal abscess,* containing a fluid which is capable of communicating syphilis to a sound person. Its progress and cure seem to be unconnected with the increased or diminished action of the venereal poison in the constitution, and to be also uninfluenced by the operation of mercury. I consider the venereal disease as a remote cause which gives occasion to the appearance of this, as well as several other diseases, that are widely different from its own specific nature." (p. 88.)]

186. The causes of whitlow are in many cases unknown; it is often, however, very common at certain periods. Sometimes a general cause, as gout, and rheumatism, seems to give rise to it; but, in most cases, the cause is local, as contusion, sudden warming of the fingers after they have been chilled, injury with fine puncturing instruments, from splinters, and so on.

To these causes **Garengeot** adds "the excrescences (or rather little shreds) which form about the nails, and are commonly known as *hagnails.*" And he observes, "that workwomen using the needle are most subject to whitlow; though, on the other hand, they protect themselves by immediately sucking their finger, thus imitating the suckers of wounds, or certain irregular practitioners; because, by this proceeding they abstract the blood which escapes from the little vessels opened by the sharp instrument, and thus prevent any deposit, and consequently also abscess." (pp. 287, 8.) Another very common cause of whitlow is the impure soda often used by laundresses in washing linen, which often either irritates any small scratch or crack there may be in the skin of the finger, or even first produces a cleft which presents the appearance of a knife having been drawn through the cuticle down to the cutis, and then, irritating the latter, sets up considerable inflammation in the shape of whitlow.—J. F. S.

Hunter takes the whitlow as an example of "the ulcerative process having no power over the cuticle, so that when the matter has got to that part it stops, and cannot make its way through till the cuticle bursts by distension." (p. 469.)]

187. The *treatment* of whitlow varies according to its different forms. In the *first* form, it may often be at the very onset dispersed by cold applications. If pus be formed, it must be soon evacuated, that it may not spread beneath the nail. If the nail, however, be loosened, it must be partially removed with the scissors, and a piece of linen spread with cerate must be laid between the edge of the nail and the soft parts, in order to prevent the irritation of the latter. If pus be collected beneath the nail, the latter must be scraped thin, so that it may be pierced with the bistoury, and the pus allowed to escape; or, if the nail be somewhat loose, it may be torn off. Generally, as it separates a new nail grows; it should be covered with wax, to give it a good shape.

[**Gibson** says "venesection, both general and topical, may be required in the early stages of whitlow; leeches especially prove very serviceable in all cases, by abating pain and reducing the inflammation These remedies, however, are seldom sufficient to procure resolution; but this has often been accomplished by the early and repeated applications of a *blister*. On the other hand, it must be stated that many patients derive no advantage whatever from the blister." He further, and very justly, notices :—" The same applications, I have observed, produce very opposite effects on different patients: thus I have known common linseed oil spread over a whitlow afford instantaneous relief in some cases, and, in others, so far from proving beneficial, aggravate all the symptoms. Soft soap or common brown soap, warmed and applied to the affected part, occasionally acts in a wonderful manner, assuaging the pain and subduing the swelling in a very short time. Poultices sometimes give relief, and are useful always in softening the skin and removing tension; but, when the swelling is very great, the pain intense, and matter evidently formed, the most effectual mode of easing the patient is to lay the part open freely with the knife." (p. 188.)

HUNTER observes, that " the application of poultices in these cases is of more benefit than in any other, because here they can act mechanically, viz. the moisture being imbibed by the cuticle as in a sponge, and thereby softening the cuticle, by which means it becomes larger in its dimensions, and less durable in its texture." He advocates of course the early opening of these abscesses; and, speaking of the fungus which almost invariably protrudes through, as also when the skin gives way of itself, he says :—" It is a common practice to eat this down by escharotics, as if it was a diseased fungus; but this additional pain is very unnecessary, as the destroying a part which has only escaped from pressure cannot, in the least, affect that which is within; and, by simply poulticing till the inflammation and, of course, the tumefaction subsides, these protruded parts are gradually drawn into their original situations." (p. 470.)

With the practice of freely opening the whitlow I fully concur, and the sooner it is done after suppuration has taken place, and the cuticle is raised like a blister from the true skin, the better. The suppuration takes place usually in twenty-four or forty-eight hours from the onset of the disease, and should be carefully watched that it may be punctured immediately the pus has been poured out. The longer cutting through the skin is delayed after this event, so much the worse; for, beside the separation of a larger extent of cuticle and even of the nail, and the continuance of violent pain from the pressure which the pent-up matter makes on the sensitive extremities of the nerves at the tips of the fingers, the pus presses also on the cutis and causes it to ulcerate, thereby rendering the cure at best tardy; and often producing a very ugly and tiresome sore. After the pus has been discharged by puncturing or cutting through the cuticle, it is best to notch out a little bit of the skin, to ensure a free and constant escape for the matter, otherwise the cut edges often become glued together by the drying of the pus between them, and then it again collects, and sometimes needs a fresh cut. If the pus be confined beneath the nail, as is sometimes the case, the nail having been scraped, it should then have a little hole carefully cut through it to let the matter out. It rarely happens that the whole nail at once separates from the true and highly sensible skin beneath, but is held sometimes at the root, side, or end according to the part at which the pus has been poured out. I do not think it advisable to thrust in lint to save the soft parts beneath, as scraping the centre of the nail, from root to tip, till it will bear scraping no longer without bleeding, or, in other words, till it is almost completely scraped through, allows the edge of the nail so to alter its place that little or no irritation is produced by it. All that is necessary is to give free vent to any matter which may exist, to keep the parts clear from any dirty or irritating substances and to prevent the loosened part of the nail (the movement of which causes much pain) being disturbed, which is best done by wrapping in a poultice, or covering with wax and oil dressing, for I am not disposed to remove any part of it so long as the cutis beneath continues suppurating, as the nail protects it best, just as the cuticle does a blister-sore, and, as the new nail forms, it gradually stretches beneath it, and then, but not till then, may portions of the old separating nail be cut off. If, however, as is sometimes the case, the loosened nail digs in and irritates the sore; if the cutis have ulcerated in consequence of the pus not having been evacuated sufficiently early, or, if it twist up, as it will occasionally do, and continually catch in the dressing, then it may be cut off. I am no advocate for tearing off the nail, nor any part of it, and I can scarcely imagine that in this form of the disease it is ever necessary.—J. F. S.

HIGGINBOTHAM advises brushing over the whitlow with nitrate of silver, and considers it very good practice. I have not, however, had any experience of it. GIBSON mentions that PERKINS of Philadelphia is said to have frequently removed whitlows in a very short time by an admixture of corrosive sublimate and white vitriol, applied to the part on lint steeped in tincture of myrrh, and suffered to remain for several days. GIBSON has tried the remedy in several instances, but cannot say it has answered his expectations in any one case. (p. 189.)]

188. The *second* form of whitlow requires, in consequence of the severity of the inflammation, bleeding or leeches to the affected finger, cold applications, and rubbing in mercurial ointment. If the cause of the whitlow be a puncture, it must be ascertained whether any splinter remain; and, if so, it must be removed; also, if any noxious matter have penetrated into a wound, it must be carefully washed out with warm water. If resolution do not occur in the first three days, the affected part must be cut into. The patient is always thereby relieved, either by the escape of the pus, or, if the pus be not perfectly formed, by the division of the tough and tight skin, and by the bleeding. The cut should always be pretty free. Soothing poultices should be applied till the pain and swelling have subsided. If the skin be thinned to a great extent, and raised like a bladder, it must be removed as soon as the pus is discharged.

[The treatment of this is precisely similar to that directed for the previous form of the disease, excepting that, in the present case, it is always necessary to cut through the cutis as well as the cuticle, and relieve the tension of both at once; the pus, if the incision be made at the proper time, not having yet ulcerated through to the cutis, and poured itself beneath the cuticle.—J. F. S.]

189. The *treatment* of the *third* form of whitlow is the same as in the second, except that the incision must not be deferred beyond the third day; for, otherwise, the tendon will be destroyed. The cut must penetrate into the tendon sheath. The pain is usually quickly diminished by the application of soothing remedies. As the inflammation often spreads over the whole hand, if in any particular part pain, swelling, and fluctuation occur, it must be opened: and as, when the tendons are destroyed, the motions of the finger are lost, care must always be taken to keep it in a proper position.

[The incision, when the sheath of the tendon is concerned, should always be made deeply and freely, and in the course of the tendon, as if that be divided longitudinally, no inconvenience accrues to the movement of the finger or toe, as would were it cut transversely. It must not be expected always to find pus flow in opening the tendon-sheath; very frequently but a drop or two escapes, and sometimes none, the secretion not having been established. The anticipation of such occurrence is not, however, to be any bar to making the incision, as the immediate relief it affords, by getting rid of the tension, and emptying the vessels of the inflamed part, and checking the high constitutional disturbance almost always attending inflamed tendinous structures, is most remarkable. If the inflammation and suppuration be propagated to the palmar or plantar fascia, or further on the arm or leg, incisions through the fascia must be made, for the voidance of the pus. As this subject will be again treated of, in considering punctured wounds, it need not at present be further pursued. As regards the sloughing of the tendons of the fingers or toes, the extent to which they are destroyed is very great: indeed, I have known an instance of slough of the entire tendon, up to its junction with the muscular fibres, of one of the flexor muscles of a finger, of which the top had sloughed off. The straight position is best for the finger, when either flexor or extensor tendons has sloughed; but very commonly, for working persons, its immobility is so inconvenient, that it is necessary to amputate it at the knuckle.—J. F. S.]

190. The *fourth* form of whitlow must be *treated* the same as the previous forms; and, if the severe pain and tightness do not diminish, an early cut through the whole must be made, to prevent the destruction of the bone. This must be made where the pain is most severe, and must be carried down to the bone. The finger must be put in decoction of chamomile if the suppuration be sluggish; it must be bathed in lye (*a*), and soothing applications employed. The bone of the last finger-joint often separates, or may be removed frequently without pain, the finger retaining its form, though rather shorter. If the bone of the second or first joint be affected, the removal of the finger is necessary. However, under the pre-

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(*a*) Common mixture of crude potash and water.

ceding treatment of soothing poultices and bathing with chamomile, the most severe cases of this kind are often cured.

[For the cure of Epinychia ABERNETHY recommends the use of "a combination of arsenic and sulphur, which, together with some herbs, formed the principal part of a quack medicine called PLUNKET's Epithema; that composition, however, was horribly painful, and produced the most horrible sloughs, not by decomposing the parts, but by exciting vehement action; I have, therefore, followed it so as to render it only a corrigent, and, in many cases, it will relieve without producing pain." For the same purpose he used also successfully the *Aqua Arsenicalis* of St. Bartholomew's Hospital, consisting of arseniate of potash, spirit, and mint water, which he considered to have an excellent corrigent effect on local diseased action. It is also well to use it mixed with basilicon; but care must be taken in its employment, for if the constitution become affected, as sometimes happens, it will make the patient very ill, and even cause temporary blindness.]

191. It is here proper to mention two diseased conditions which depend on changed form and direction or unnatural structure of the nail, or are therewith connected; *growing of the nail into the flesh*, and *inflammation and suppuration of the surface producing the nail.*

192. The Ingrowing of the Nail into the flesh depends less on an increase of the breadth of the nail, than on the pressing upwards of the soft parts. It is ordinarily consequent on squeezing together of the toes by tight shoes, especially if the nails be cut too short, and is almost confined to the great toe, specially to that side of it next the second toe. The irritation of the edge of the nail causes inflammation; at first, the secretion of a serous fluid which dries to a callous mass; subsequently suppuration and fungous excrescences spring up, which spread over the nail; the disease may even assume a carcinomatous character, or the inflammation may extend to the bone. The nail itself grows thicker, and is frequently softened at the ulcerated part. The pain in the severe form of this disease is always very great, and walking often becomes quite impossible.

[The commencement of this disease has been well-described by WARDROP, who says:—"This affection is chiefly confined to the great toe. It frequently happens, when the foot is kept in a tight shoe, that the soft parts situated on the edge of the nail thicken, are pressed over it, and become more or less inflamed and painful. If the inflammation and thickening of the soft parts increase, the edge of the nail becomes at last completely imbedded in them, and its sharp edge, from the pressure of the body when resting on the foot, increases the inflammation, and produces suppuration of the contiguous soft parts. Thus the hard and sharp nail, by pressing on the surface which has become ulcerated, causes great pain and lameness, and in many cases, prevents the person from walking. The ulceration generally extends round a considerable part of the nail, and a fungus arises from this surface, accompanied by excessive irritability." (p. 130.)

This, "the first variety," says DUPUYTREN, "consists of the ulceration sometimes of one, sometimes of both the lateral edges of the nail at once. It almost always happens on the outer edge. If the conformation of the nail be remembered, if the flatness of its body, the direction of its corners, its situation in the thickness of the skin which surrounds and covers it, we may easily conceive how a tight or ill made shoe, producing a constant pressure on the nail, will forcibly thrust its corners upon those parts of the skin where it rests. By degrees these corners, always more or less sharp and cutting, bury themselves into the skin, with the greater facility as the skin itself pushes upwards and outwards, and endeavours to cover them; finally, the irritation increases by walking, and produces a very painful inflammation. Such is really the most common cause of the incarnation of the outer edge of the great toe. The affection almost always commences at the point of union of the front with the side edge of the nail, and appears to be occasioned by the fold that forms in the flesh; as this interrupts the action of the scissors while cutting the nail, they are almost invariably checked before they can cut away the whole of its front edge, especially at that point where an angle is formed by union of the nail with its corresponding lateral edge. This allows the remaining nail to grow, which soon forms a sharp point, punctures, and cuts into the flesh, and gives a sort of signal of ulceration which soon spreads along the corresponding edge of the nail. So sure is it that this point is constantly found on the nails which have been torn off. Scarcely has the nail cut itself into the skin it covers, than the pain becomes very severe; walking, and even standing, are unbearable; a serous or sero-purulent oozing establishes itself in the part affected, and, if the patient take exercise, the whole foot swells. The pain, however, continues increasing, the oozing becomes more abundant, and the sanious pus which escapes has a smell more fetid from mixing with the perspiratory humour of the feet. The patient, tormented with pain, is driven to raise the nail and cut it back; but this proceeding, though sometimes causing momentary relief, far from curing increases the difficulty of the treatment. Finally, if the disease be left alone, the ulcer produced sometimes runs into a cancerous state, sometimes is covered with enormous vegetations, sometimes even the inflammation is propagated to the periosteum, and soon gives rise to caries and necrosis of one or more phalanges." (p. 46.)

Dupuytren also mentions that this disease is liable to be confused with some others, and instances a case which, for eight years, had been treated as if depending on gout.

Colles (a) observes, that "the colour of the fungus is rather florid; surface is smooth; the discharge is purulent, in small quantity, and tolerably healthy, unless the part have been irritated by too much exercise of the limbs, or by some external inflammation or local injury: there is little or no surrounding inflammation, no enlargement of the toe, and the pain is in general trifling, unless during exercise, when the weight of the body on the limb causes the nail to press into the soft substance of the fungus, which thus often induces considerable uneasiness and lameness. This disease does not appear to me to have any tendency to spread to, or to involve, the adjoining parts, as I have seen cases in which it has remained stationary for some months, and in one for two years; at the end of which period the symptoms were in no way more severe than at the commencement, although most writers assert that it generally passes into malignant onychia. The origin of this troublesome affection is usually attributed to the effects of a tight boot or shoe, or to some accident in cutting or breaking off the end of the nail; in many instances, however, no cause can be recollected or assigned for its occurrence." (p. 241.)

Colles, however, speaks of the form of disease liable to be mistaken for gout as quite distinct from that just described. He says:—"There is another morbid affection which occasionally engages the anterior and inner angle of the great toe nail, and which causes considerable lameness and uneasiness, particularly on pressure; this affection is often mistaken for an attack of gout, especially in those persons where such an attack may be expected or even desired. In this disease there is no swelling or redness; but pain, on pressure, at the anterior and internal angle of the nail. On close examination of this spot, we find that this angle rests on a hard white mass of laminated, horny cuticle, which we can easily remove in bran-like scales, when we shall see a small cup-like cavity, without any ulceration or disease. The ungual angle appears thick and bulbous opposite this point, and the pain is caused by its pressing against this mass. * * * I may remark I have never seen this disease engage the outer angle, neither have I seen that last described engage the inner angle of the toe-nail." (pp. 244, 5.)

193. In the slighter forms of this disease, it may always be easily relieved by inserting a slip of lead under the edge of the nail which is to be fixed, there by twisting round it a piece of sticking plaster; by which means the nail is raised and the flesh depressed. If there be fungous excrescences, these must be first removed with lunar caustic, or cut off with the knife. It would be too painful at once to insert the plate of lead beneath the edge of the nail; but it is also unnecessary, as its insertion under the front edge, if the nail be allowed to grow, gradually raises the hind part, and then the lead may be further introduced. When the nail has recovered its proper direction, it must not be cut too short nor rounded at the sides, but only shortened transversely. With these precautions, this treatment, recommended by Desault and Richerand, has, in almost all cases, answered my wishes. Introduction of charpie or wax beneath the edge of the nail is useless.

Biessey (b) scrapes the whole free surface of the nail till nearly its entire thickness is destroyed, particularly in the centre. Then he touches the scraped part five or six times, more or less severely, with lunar caustic until the nail contracts completely, and draws out of the flesh. He then lays pads of charpie under the edge of the nail, till by its growth it stretches over the bulbous part of the toe. Zeis (*a*) especially recommends the introduction of charpie under the edge of the nail, and the use of foot-baths.

(a) Observations on some Morbid Affections of the Nail of the Great Toe; in Dublin Journal of Medical Science, vol. xxiii. 1843.

(b) Remarks on Inverted Toe-Nail; in Philadelphia Journal of Medical and Physical Sciences, vol. ii. 1821.

[The treatment recommended by Meigs (*b*) is very simple:—"Let a small pledget of lint, just large enough to cover all the granulations, and of sufficient thickness to act as a compress, be neatly adjusted, over which a roller of linen, three-quarters of an inch wide and eight or ten inches long, is to be applied, having one end previously spread with adhesive plaster. By this method we are enabled, with great ease, to make it not only act on the compress, which will destroy the granulations very rapidly, but, by confining the toe and nail, to prevent even the small degree of sliding motion or friction of the latter over the wounded part, thus doing away one principal cause of the disease. By pursuing this treatment, the patient will generally recover, even while walking about." (p. 266.)

Astley Cooper says, that "the application of a blister will bring away the cuticle, and often the nail along with it." (p. 193.) I have tried this plan several times, but have rarely succeeded in inducing the separation of the nail.—J. F. S.]

194. It is not possible, however, in many cases to render assistance by this treatment, partly because the nail has gone in too deeply, and is too much covered with fungous growths, partly because it is too painful. Here the treatment proposed by Dupuytren is applicable. When the inflammation of the toe is diminished by poulticing, rest, and so on, a pair of straight sharp scissors, of which one branch is very pointed, must be thrust by a sudden motion from before backwards, from the front edge to the middle of the root of the nail, to at least three lines behind its hinder edge, thus dividing the nail into two halves. The diseased halves are then to be taken hold of and twisted round, all connexion destroyed, and the nail itself removed; the same must be done with the other half, if necessary. If the fungous excrescences are high, they must be destroyed with caustic, by which the skin beneath the nail dries, the sore surface disappears, and in from twenty-four to forty-eight hours is cicatrized. In old persons the nail is generally not replaced; in young persons it sometimes reappears; a recurrence of the disease is, however, rarely to be feared.

[According to Scoutteten (*c*), if it is determined to destroy the matrix of the nail, the point of a straight bistoury should be placed upon the middle of the diseased phalanx, about four lines from the edge of the nail, and the skin divided down to the nail. The cut should not penetrate deeper than the matrix, as this only is to be exposed. The edges of the wound are then to be raised from the nail and kept asunder by the introduction of charpie. On the day following the little wound must be filled with a caustic paste, (five parts of caustic potash, and six of quicklime, moistened with alcohol immediately before use,) and the dry phalanx covered with sticking plaster, the excrescences must be destroyed by the gradual application of the caustic; and, after the falling off of the slough, until the healing is complete, which takes place usually in twenty-four days, there is nothing to do except merely to cut away the exposed edges of the nail with scissors.

The following are Paré's and Faye's treatment. The former consists in thrusting in a straight bistoury at the base of the soft parts which cover the nail, and dividing this part from before backwards to the edge of the nail, then the bistoury is to be turned to the other side, and the flap perfectly removed. Cauterization is to follow. In Faye's method a V-shaped piece of the nail (first scraped thin) must be removed out of the front edge, and through the two edges a metal wire drawn and twisted together, by which the edges of the cut are approximated, and the in-growing edge of the nail raised up.

Of the various modes of treatment which have been recommended for the cure of the in-growing nail, compare Michaelis (*d*), Sachs (*e*), Zeis (*f*).

Astley Cooper first proposed the operation of, "with a pair of scissors, slitting up the

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(*a*) Cursory Remarks on Inverted Toe-Nail; in Philadelphia Journal of the Med. and Phys. Sciences, vol. ii. 1821.

(*b*) In Danzel, Essai sur l'Ongle Incarné; suivi de la description d'un nouveau Procédé Opératoire. Strasbourg, 1836.

(*c*) Remarques sur le Cours d'Opérations de Chirurgie de M. Dionis. 8vo. 1736.

(*d*) In Journal von Graefe und von Walther, vol. xiv. p. 2,4.

(*e*) Ibid, Vol. xxii. p. 108.

(*f*) Above cited.

nail on that side where the disease exists, and then with a pair of forceps turning back and completely removing the divided portion. This is a very painful operation certainly; but I have known persons get well by this treatment in ten days, where the complaint had for months resisted every other. The applications to be used after the operation are of little importance; poultices are the best, and these will be required but for a very limited period, for the irritating cause having been removed, the fungus will soon disappear." (pp. 192, 3.) Nearly the same plan was followed by **Dupuytren**, as above described.

I entirely concur, however, with the observations made by **Colles** on this point. He says:—"This operation inflicts a great degree of suffering, because in this disease the nail is not, as in onychia, separated from the vascular and highly sensitive matrix, except only through a small extent of space, not more than a quarter of an inch at its external angle, and, therefore, the scissors pushed upwards between the nail and the adherent matrix, and the forcible evulsion of the former by the forceps, must cause exquisite pain, which, though of short duration, can be regarded as nothing short of actual torture. * * * I am by no means an advocate for this peculiarly painful and distressing operation, but, on the contrary, I believe we may be relieved from the necessity of performing it, and that we can, in all instances, effect a permanent cure by a very simple operation, and one comparatively free from suffering; namely, by confining the excision of the nail to so much only as is already detached from the matrix; all of this portion, as well as that imbedded in the fungus, must be removed." His operation consists in having the fungus pressed down with a spatula, and the edge of the portion of nail to be removed seized with strong flat-blade forceps; the flat end of a probe is then thrust beneath the nail as far as it will go directing it towards the outer edge, and upon the pointed edge of a pair of stout crooked scissors is to be carried, with one stroke of which the detached portion of nail is cut off, and then drawn away by the forceps with moderate force. But, if this be insufficient, the probe is to be passed still higher, the scissors introduced again, and a second cut frees the nail: sometimes a sharp momentary pain occurs from the point of the scissors penetrating the sensitive matrix. The only dressing required is "a small bit of dry lint, to be pressed firmly between the fungus and the edge of the nail." In a few hours the toe is free from pain, and the patient can walk without any lameness or uneasiness in three or four days after the operation. The dressing continues perfectly dry, and need not be changed till the fourth day. At this time the fungus will be found much reduced in size, perfectly dry, and of a firmer consistence. * * * In the course of ten or fifteen days the fungus will have entirely disappeared, and the parts be restored to a healthy state. * * * The result of the operation is not in all cases so successful, for, in some instances, four or five days after the operation, the patient will complain of some uneasiness in the toe, when we shall find on examination that the dressing is moistened with a little discharge, and that a small portion of a whitish substance, like soft and swollen leather, is rising up through the fungus. This substance, may be, regarded as a sort of accessory ungual filament, arising close to the original nail, from the anterior and outer border of its matrix, and which is now altered in texture and direction; this filament is so soft that it breaks and tears, if caught by the common dissecting forceps." (pp. 243, 4.)]

195. The Inflammation and Suppuration of the Surface which produces the nail, (**Dupuytren**'s matrix of the nail,) which **Wardrop** has pointed out as a peculiar kind of whitlow, (*Onychia maligna,*) begins with dusky redness and swelling of the soft parts in the neighbourhood of the nail; an ichorous fluid oozes between the nail and soft parts; ulceration takes place at the root of the nail; the neighbouring parts become swollen, dusky red, and the pus which the sore secretes is ill-conditioned and stinking. The nail loses its colour, becomes gray or black, and does not grow, so that it shortens and loses half its width; sometimes it entirely disappears, and only a few streaks of horn are seen here and there; sometimes part is concealed under the fungating flesh; in many cases it is completely separated. This state may continue for many years, and the toe or finger become converted into a shapeless mass. This disease is frequently very painful, especially when touched; the fungations (which do not, as in simple ingrowing of the nail, arise on the side, but are seated at the root of the nail) bleed, on walking and standing.

[As **Dupuytren** observes, "the formation of this second species will be better understood after saying a few words on the anatomical structure of the nail. Its adherent extremity, the only part at present needing study, is implanted in the skin in a peculiar manner; the latter, having passed on the dorsal surface of the nail, is reflected, and, having reached the hind end, divides, into two portions, the epidermis which covers the whole superficial layer, and the cutis which passes beneath the nail, and is continuous with the skin covering the free extremity of the finger. The *cul de sac*, in which this part of the nail is received, is called the *matrix*. It is, then, very important to be acquainted with this disposition of the organ, as fully explaining why the nail received into the flesh is, in many cases, only produced by the ramming in (*refoulement*) of its free extremity into the *cul de sac*. This alteration may take place in consequence of the running over, or fall of a heavy weight upon the great toe. Whatever may be the cause, the patient at first complains when walking of a pain which gradually increases; the kind of *cul de sac*, lodging the base of the nail, reddens and inflames, as well as the bottom of the fold which receives its lateral edges; ulceration is soon observed, which makes rapid progress; its form becomes semilunar, its edges elevated and hard, its base red, violet, and livid. The nail shortens and diminishes to half its size, sometimes even entirely disappears, and in its stead are observed, here and there, pencils of horny substance; often, also, part of the nail is hidden under fungous flesh. These fungosities serve to distinguish this disease, resulting from primitive alteration of the skin, from that consequent on the nail digging into the flesh. When the disease is caused by the nail, the fungosities originating from the inflammation occur on the front and sides of the nail; but when, on the contrary, it depends on the affection of the skin, the fungosities are always observed at the root of the nail. The colour of the nail in these cases is gray and black; sometimes it does not retain its ordinary connexions; the sore is generally bathed in a sanious or sanguinolent suppuration, and spreads far and wide a fetid smell. If the patient walk, or even remain standing upright, the fungosities bleed: every kind of shoe is unbearable, and the least rubbing is extremely painful. In general it is impossible to remain in the same place with persons who have this disease, as the stench which circulates around them, and clings to their clothes, is infectious and penetrating, being produced by the union of the ichorous pus oozing from the bottom of the ulcer, and the copious sweat which the feet of these patients secrete." (p. 61–4.)

Colles mentions:—"When the original nail has been cast off, we usually see projecting from the sides, and tarsal border of the ulcer, a narrow plate of a white substance, not unlike white leather soaked in water; this sometimes forms one continuous shelf all around the ulcerated border, projecting in a peculiarly prominent manner, that is, rather at an angle to, instead of being a plane parallel with, the dorsal surface of the phalanx. In some cases this white substance (which is the result of an abortive attempt to produce a true nail) appears only in detached spots or flakes, the intermediate parts of the ulcerated margin being devoid of any such growths; they are most frequently seen at the posterior and anterior angles of the nail, but occasionally in other parts of the circumference. The surrounding integument is discoloured, being often of a livid or purplish tint; it is also indurated, and exudes a copious perspiration, of a peculiar heavy odour. This ulceration sometimes induces caries of the bone, and even extends to the phalangeal articulation." (p. 246.)

Wardrop says:—"In this state I have seen the disease continue for several years, so, that the toe or finger became a deformed bulbous mass. The pain is sometimes very acute, but the disease is more commonly indolent, and accompanied with little uneasiness. It affects both the toes and the fingers. I have only observed it on the great toe, and more frequently on the thumb than any of the fingers. It occurs, too, chiefly in young people; but I have also seen adults affected with it." (p. 136.)

"When the disease, more especially, attacks that part of the skin immediately beneath the nail, then," says **Dupuytren**, "is it observed to be raised by the development of little tumours, the presence of which cause pain in proportion as the pressure is more considerable. They are of different kinds, fibrous, cartilaginous, bony or vascular; and the proof of their development, simply depending on alteration of the cutis covering the nail, is, that if they are removed, without, also, taking away the skin from whence they spring, the skin generally, again, becomes diseased, ulcerates, and sooner or later requires complete removal." (p. 64.)—J. F. S.]

196. The causes of this disease are either *local*, mechanical, or chemical, for instance in persons having much to do with alkalies; or *general*, herpetic, but especially syphilitic, dyscracy. Several fingers and toes of both

hands and feet are then attacked at the same time; the disease commences sometimes with little sores in the clefts between the fingers or toes, which extend around the origin of the nails; these separate from their root. The disease ordinarily resists mercurials.

197. In the *treatment* of this disease internal remedies are to be employed, according to its different causes, and local, according to the degree of irritation; leeches, soothing applications, baths, and so on, and the foot kept quiet. **Astley Cooper** recommended a grain of calomel and opium night and morning with decoction of sarsaparilla, and the application of lint steeped in lime water and calomel, (*black wash*,) covered with oiled silk. If this treatment be ineffectual, the nail with its secreting surface should, according to the opinion of both **Dupuytren** and **Cooper**, be removed. According to **Dupuytren**, the foot is to be steadied, and the diseased toe held with the left hand; a deep semicircular cut is then to be made with a straight bistoury three lines behind the skin in which the nail is supported, and parallel to its fold. An assistant then holds the toe, whilst the operator raises the flaps from behind forwards with a pair of forceps, and dissects away the skin which produces the nail; if any shreds of nail remain they must be gradually destroyed. This operation is very painful, but of short duration. The toe must be enveloped in pieces of linen perforated and spread with cerate, and a thin bundle of charpie with a compress put upon it; the patient put to bed, and the foot half bent laid on a pillow. The pain subsides some hours after the operation, and, on the third or fourth day, when the bandage is removed, the wound is found covered with good pus, and is then to be simply dressed. The granulations are to be touched from time to time with lunar caustic; if new shreds of horn are formed, they must be pulled out, and the part producing them be cut away. Usually in from fourteen to eighteen days the patient can return again to his business. The scar is a smooth thick nailless skin, which sometimes acquires a horny consistence. If the disease depends on syphilis, **Dupuytren** treats it with *liq. hydr. nitr.*

I must deny the assertion that in this disease the tearing out the nail and the employment of caustic are of no effect. I have in several instances torn out the nail, and merely employed soothing poultices and bathing, and have effected permanent cure. I, therefore, only have recourse to extirpation when the above treatment has not any permanent result.

[In regard to the treatment of this disease, **Wardrop** says:—" The only local treatment I have ever seen relieve this complaint has been the evulsion of the nail, and afterwards the occasional application of escharotics to the ulcerated surrace. But even this painful operation in some cases does not succeed, and will seldom be submitted to by the patient; he must, therefore, either continue lame or submit to the removal of the member. Other surgeons have cut out the soft parts at the root of the nail, an operation equally severe." In preference, therefore, **Wardrop** recommends the internal exhibition of mercury, which he has found beneficial, " in small doses at first, and gradually increased, so as in twelve or fourteen days sensibly to affect the gums. The sores, in general, soon assumed a healing appearance after the system was in this state, and the bulbous swelling of the joint gradually subsided. The ulcers were dressed with wax ointment, so that the effects of the mercury might be watched; and, after the sore began to heal, a weak solution of the muriate of mercury and escharotics were occasionally used to clean the wound. The mercury was continued till the ulcers were perfectly healed, and, as is generally advisable under such circumstances, it was taken in smaller quantities for some time after the patients were apparently cured." (p. 138.)

Colles, admitting that "the complete removal of the entire of this diseased matrix does effect the cure in a very short space of time, provided the bone or joint is not diseased, (in which case amputation is inevitable,) and that subsequently rest and simple dressing will alone accomplish the healing process, the place of the nail being supplied by adverse hard skin," objects to the operation, not only for its severity, but because "it also too frequently happens, that the disease returns in some one spot or other, owing to the matrix not having been wholly eradicated, which, indeed, it is often extremely difficult to do, for the shape of the toe is so bulbous, and so deformed, the texture so changed and so condensed by chronic inflammation, and the edges of the ulcer are so raised over the part to be removed, that even an anatomist cannot easily recognise the relations of the several tissues involved in the disease, or ascertain the exact extent of the substance to be excised." Hence, "some days after the operation the patient becomes alarmed, by feeling a slight return of his former uneasiness, on any exercise of the limb, or any pressure on some particular spot, generally on one of the angles of the original ulcer; and on careful examination there is found still a little ulceration, and a fresh production of that ungual growth already described, and indicating the persistence of some of the diseased matrix." (pp. 246, 7.) This causes a repetition of all the suffering, and requires removal a second, or even a third time. Colles, therefore, prefers the following plan, which in a few days will induce a considerable amendment, and even a perfect cure in the course of three or four weeks:— * * * "I confine the patient to bed, and direct a poultice to the toe for two or three days. I then cleanse the ulcer carefully, by directing on it, from some height, a small stream of tepid water, from a sponge. I next cut away as much of the loose nail as I can, without paining or irritating the sensitive surface around, and then I fumigate the part by means of the mercurial candle, containing *hydr. sulph. rubr.* ʒj., *ad ceræ* ℥ij. This fumigation is to be applied night and morning, and, after each, the toe should be gently enveloped in lint or linen, lightly spread with *ung. spermac.* In four or five days the patient will express himself considerably relieved; the discharge from the ulcer will be found of a healthy, purulent character, and the appearance of the whole part much more favourable. The fumigation is to be still persevered in, and all projecting portions of nail to be closely cut. I consider this latter direction as very essential, as thereby the mercurial fumes can have more free access to the surface of the ulcer. In proportion as the ulcer improves it is interesting to observe, so does the condition of the growing nail; it acquires not only its natural firm and horny consistence, but also assumes its proper horizontal direction. For some time after the general surface of the ulcer has been healed, there still remain small spots of ulceration, generally at the angles around some white germs of new nail; against these points the full force of the mercurial vapour should be directed. This can be effected by adding a small conical wavy tube to the funnel. I attribute much of the success of this treatment to the use of the mercurial candle in preference to fumigation in the ordinary way. During this treatment the patient must absolutely abstain from walking or even standing on the affected limb; exercise but for a single day will counterbalance all the amendment produced by a week's rest and fumigation." (pp. 348, 9.) Colles did not employ any constitutional treatment in his cases, but he thinks it may sometimes be required.

I have never employed this mercurial treatment, and, therefore, only mention it on Wardrop's authority. Neither have I ever torn out the nail, nor dissected away the nail gland, although I admit that either is very efficient, because I believe they are horribly painful, and not absolutely called-for operations, and may, therefore, be avoided. The only advantage, as seems to me, resulting from their preference is, that the disease is cured rather more quickly. My own observation convinces me that cauterizing the nail gland with nitric acid is equally efficient, though not quite so speedy. It should be run quickly round the gland with a bit of stick in sufficient quantity to destroy it, otherwise a second application will certainly be needed; and, as soon as it has dried, a poultice should be applied. If successful, the nail in a day or two curls up out of the matrix, and gradually separates from the rest of its attachments; but if it do not, the acid must be applied again, and, if properly done, will not generally call for repetition.—J. F. S.]

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VIII.—OF THE INFLAMMATION OF JOINTS.

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198. The various parts of which the joints consist, stand in the most intimate relation with each other; therefore, in disease of any one, all the other parts are gradually drawn into participation. We speak of the *ligaments* and *synovial membrane*, the *cartilages*, and the *spongy ends of bones*. In each of these structures inflammation may be set up as the primary disease, which may be communicated to the others, and various organic changes be produced, which are described as *Articular Fungus*,

(*Fungus Articulorum*, Lat.; *Gliedschwamm*, Germ.; *Fongus Articulaires*, Fr.,) *White Swelling of the Joints*, (*Tumor Albus Articulorum*, Lat.; *Weisse Gelenkgeschwulst*, Germ.; *Tumeurs Blanches*, Fr.,) *Arthrocace*, *Dislocations from their original place*, (*Luxationes Spontaneæ*, Lat.; *Verrenkungen aus inneren Bedingungen*, Germ.; *Luxations Spontanées*, Fr.)

In reference to joints, Hunter (*a*) observes:—"They being circumscribed cavities, are subject to the same diseases as other circumscribed cavities, as inflammation, &c.; but their peculiar structure sometimes renders their consequences different. Nature is very little disposed to take on the adhesive inflammation, because the necessary consequence would be a loss of motion in a part originally intended for motion. This makes inflammation in joints so much worse than many other circumscribed cavities; for, as before observed, if adhesive inflammation does not come on, the inflammation and consequent suppuration must spread through the whole cavity. * * * Inflammation in joints is generally of more serious consequence than in other parts; even when resolved it is disagreeable; yet this is always to be wished for." (pp. 519, 20.)

199. *Inflammation of Joints* (*Arthrophlogosis*, Lat.; *Gelenkentzündung*, Germ.; *Inflammation des Articulations*, Fr.) is either idiopathic or symptomatic, and its course acute, subacute, or chronic. The causes are external injury, cold, and general diseases, which either of themselves or after the previous operation of local mischief produce disease of the joint, as scrofulous, gouty, rheumatic affections, syphilis, diseases of the skin, metastasis, suppression of the ordinary secretions, and so on. The reason of their beginning sometimes in the soft, sometimes in the hard parts, depends perhaps on the different relations in which the general and local causes stand to the production of the disease.

A.—OF THE INFLAMMATION OF THE LIGAMENTS.

200. When inflammation takes place in the fibrous structure of a joint, (*Inflammatio Ligamentorum*, Lat.; *Entzündung Gelenkbänder*, Germ.; *Inflammation des Ligaments*, Fr.,) it is only in certain stages confined to that alone; but, in its further progress, it spreads to the cellular tissue surrounding the capsule of the joint without, and the synovial membrane within. Its course is more or less acute or chronic.

[In regard to the rarity of affections of the ligaments independent of other parts of a joint, Brodie observes:—" The ligaments cannot be regarded as more exempt from disease than the fibrous membranes, which they very nearly resemble in their texture. It is not improbable that some of the pains which take place in the joints, in syphilitic affections, may depend on a diseased action occurring in the ligaments; and there can be no doubt that the long continued symptoms which occasionally follow a severe sprain, depend on these same parts being in a state of slow inflammation, in consequence of some of their fibres having been ruptured or overstretched. I cannot say that I have never seen a case where disease, independently of these causes, has originated in the ligaments; but I certainly have never met with a case where it has been proved to have done so, by dissection, and it may be safely asserted that this is a rare occurrence, and not what happens in the ordinary diseases to which joints are liable." (p. 7.)]

Among the "variety of cases," mentioned by Mayo, "in which the ligaments appear to be the parts exclusively or principally affected," is one arising from a blow on the knee, in which, "after many weeks confinement to the bed or sofa, the least exertion was followed by heat and pain in the knee. The joint was, in a slight degree, larger than the sound knee; but it contained no fluid; and pressure of the articular surfaces against each other, produced no pain. It caused no pain to rest his weight upon the extended knee; but when he stood on the other leg, and allowed the diseased knee to hang or swing, he felt uneasiness in it, which was greatly increased by twisting the knee. When he remained perfectly still, he would experience no uneasy feeling in the joint for several days together; and then, without any visible cause, the joint became a little heated and the skin slightly reddened. The same effects followed any deviation from the strictest

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(*a*) Lectures on Surgery; in Palmer's Edition of his Works, vol. i.

rest." (p. 79, 80.) Now, if the injuring cause here mentioned as "a blow," be "a twist or wrench," from the foot slipping, or by falling on the hand, the symptoms are precisely similar in their immediate appearance, and their long continuance. Whether, in such cases, the ligamentous fibres are simply stretched beyond what they can bear with comfort, or whether they are actually torn, in however slight degree, is very difficult to determine; but that they at once become as painful before any inflammation can have been set up, as they afterwards are when they are said to be inflamed there is no doubt. Still, however, this seems the very utmost we know, and little enough it is, of inflammation of ligaments, and I fully concur in the following observations of WICKHAM of Winchester, who says:—"We have no reason, *à priori*, to suppose that the ligaments are not liable to primary disease, or that a lesion of these structures may not originate complaint, and propagate it to the other component parts of the joint. The result of my observation, however, has been, that the ligaments are the last of all the different parts diseased, and that it is very common, on dissection, to find the ligaments perfect and uninfluenced by disease, even when every other texture is either altered or destroyed. The intimate connexion of the capsular ligament with the cellular tissue which invests it, and the synovial membrane which lines it, renders it difficult to distinguish inflammation begun in the ligaments, from diseased action commencing in those other parts; and, in its first stages, I should think it impossible to detect it; in the latter stages it has so blended itself with disorganising effects of disease in other parts as not easily to be selected as giving rise to primary affections." (p. 98.)]

201. In *Acute Inflammation of the Ligaments* there is more or less severe pain, increased by pressure and motion, and accompanied with a feeling of heat and warmth; sometimes there is also an elastic, tense, not hard, shining swelling, which, in very severe inflammations, is red and extremely painful, and most prominent at those parts where the joint capsule is merely covered by skin and cellular tissue. The limb is bent. The pain is not simply confined to the joint; it spreads in the course of the tendons, and by the periosteum, over part of the limb, which frequently becomes œdematous. Fever is always connected with a high degree of this inflammation; frequently the fever precedes, and the inflammation follows it. If the inflammation do not subside, it spreads upon the synovial membrane, and then produces the changes hereafter to be mentioned; or it runs into a chronic condition, in which the pain subsides, but the swelling increases. If this inflammation come on less actively, *i. e.*, in a subacute form, it may continue a very long time.

[I do not know in what respect simple acute inflammation of ligaments differs from acute rheumatism; nor how they are to be discriminated primarily except by reference to the constitutional disturbance which, in this condition, is a very uncertain sign. But that they are different I think there cannot be a doubt; as, in the one case, the disease is propagated to the other parts of the joint, and the ordinary results of inflammation attacking mucous surfaces, viz., suppuration and ulceration, ensue in the cavity of the joint itself; whilst, in rheumatism, the affection is confined to the ligaments and the parts exterior to or enveloping them, and consists only in the effusion of serum or adhesive matter into the cellular tissue, thereby increasing the bulk and interfering with the motions of the joint. I must confess that I am ignorant of the signs which indicate simple inflammation of ligament, independent of rheumatism or of injury, and that I do not know the peculiar symptoms which point out the extension of inflammation to the ligaments, from the synovial membrane or proper tissue of joints. As seems to me, all our knowledge of inflamed ligaments is merely negative, except, perhaps, so far as concerns the injuries to ligaments known as sprains. I say perhaps, because in sprains the pain, on motion, which is held to be one principal sign of inflammation, occurs immediately after the accident, and before it is possible that inflammation can have occurred, however early that condition may, under these circumstances, be set up; and, if the part be carefully preserved in a state of repose, pain does not exist, nor is any other sign of inflammation present, although the slightest movement will produce excruciating pain; to explain the production of which, some other cause than inflammation must be sought for.—J. F. S.]

202. *Chronic Inflammation of the Ligaments* either begins with acute pain, or comes on gradually with a less degree of pain, observable only on

pressure and motion, and entirely subsiding when the patient is at rest; with a soft, doughy-elastic, colourless swelling, which frequently, like the pain, is but partial; usually, however, the whole joint is affected; it becomes shiny as the swelling goes on, penetrated with varicose veins, and is mostly somewhat warmer than the healthy parts, in which it is gradually lost. As the swelling increases, the limb wastes, becomes bent at the joint, and all extension is impossible, on account of the thickening of the ligaments and cellular tissue; the patient has the sensation of weight, weakness, heat in the whole limb, and is frequently, from time to time, attacked with severe pain.

203. Acute inflammation of the ligaments may be resolved under proper treatment, in which case simultaneous critical symptoms of fever appear, the inflammation subsides, and there remains only for a long time slight swelling and stiffness of the joint. Rarely, and only in rheumatic and gouty subjects, does metastasis take place to other parts. Very severe inflammation runs either into suppuration and abscess on the external surface of the capsular ligament, or, when continued, upon the interior parts, into suppuration of the joint and carious destruction, in which case the local and general symptoms hereafter to be described occur. In chronic inflammation the thickening of the ligaments, and the cellular tissue surrounding them, may be very considerable without the deep parts of the joint being attacked. This swelling is rarely dispersed entirely; generally, there remains thickening of the ligaments, with impeded motion of the joint, and a greater or less degree of bending of the limb; just as in gouty inflammation, swellings, and knots arise from earthy deposits. If the chronic inflammation attack the synovial membrane, earlier or later suppuration of the joint is produced, and the happiest result is *anchylosis;* but generally hectic consumption is produced.

204. Examination of the joint presents various changes in the structures affected, according to the degree and duration of the inflammation. In the more trifling form, the ligaments, and their investing cellular tissue, are thickened; subsequently they are changed into a brawny or fatty, grayish, white, yellowish or brownish mass. The synovial membrane often remains unchanged for a considerable time, or, at the utmost, has a wrinkled appearance. In the further progress of the disease, however, it is drawn into this fatlike degeneration; so that the whole of the joint presents a homogeneous mass, in which are dispersed white membranous shreds, vessels, and tendons, and not unfrequently abscesses from the size of a pea to that of a hazel nut (*a*). This mass gradually involves the healthy cellular tissue, and even extends to the muscles. If further destruction occur in the joint, all those changes take place which are alluded to in other forms of inflammation of the joints.

[Key (*b*) says, that, "in ligamentous fibre, the process of ulceration appears to be accompanied with some peculiar circumstances. The ligament, instead of preserving its usual form and size, becomes distended, and feels pulpy. When cut into, the fibres are found to be separated from each other by a vascular structure, which, upon being injected, has a villous appearance. This interstitial vascular mass is the reticular membrane, that in the healthy structure unites the ligamentous fibres; under inflammation it becomes highly vascular, and assumes the appearance alluded to, while the fibres of the ligament retain their natural glistening appearance, until, in the progress of the disease, they at length become softened and pulpy previously to their undergoing absorption. It is not

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(*a*) Jæger; in his Handwörterbuch der gesammten Chirurgie und Augenheilkunde, Leipzig, 1836, vol. i. p. 537.

(*b*) On the Ulcerative Process in Joints; in Med.-Chir. Trans., vol. xviii. 1833.

improbable that the ligamentous fibres themselves are passive in the ulcerative process which, there is some reason for believing, is performed entirely by the vascular tissue that surrounds them." (p. 215.)

Sometimes, young people, from being compelled by their occupation to bear heavy weights, and especially from wheeling heavy barrows, have the plantar ligaments of the foot, or the inner lateral ligament of the knee, very considerably lengthened; and, as regards the lateral, that very common condition of the joint in labouring persons called knock-knees or in-knees, a very remarkable instance of which is mentioned by **Wickham**, in which "the left leg was so affected by this lateral inclination that the leg was nearly at right angles with the thigh." (p. 100.) Not unfrequently, also, are the ligaments of a joint generally relaxed, and thereby the strength of the joint greatly diminished, when large quantities of synovial fluid, produced by inflammation and long continuing, have at last been absorbed. In neither case, however, is there any actual disease of the ligament, but simply are they relaxed.—J. F. S.]

205. The causes of inflammation of the ligaments may be all the general causes already mentioned, (*par.* 199,) especially the traumatic and rheumatic in scrofulous and lymphatic persons, in whom particularly the chronic form of this inflammation is most common. It may occur in all joints, but it is most common in that of the knee and elbow.

206. The *treatment* must be guided by both the degree of the inflammation and its cause. In severe traumatic inflammation, general, but especially repeated and free local blood-letting by leeches, cold applications, and a corresponding general treatment must be employed. Perfect rest in this, as in all other forms of inflammation of the joints is absolutely necessary. In rheumatic and gouty inflammation in the slighter stages, warmth is to be applied, by rolling in flannel, woollen, and the like, and the internal use of diaphoretics, as hydrochlorate of ammonia, antimonial wine in small doses, or wine of colchicum seeds; in more severe inflammation, more active antiphlogistic treatment is called for, always, however, with caution and proper restriction. In the chronic course of inflammation, repeated blood-letting by a small number of leeches or by cupping-glasses must be employed. If rheumatism or scrofula be the ground of the disease, the internal use especially of *vinum colchici* and cod-liver oil is requisite. As the inflammation subsides, mercurial friction and repeated blisters are very advantageous.

207. If without further inflammation thickening and swelling of the ligaments and cellular tissue occur, their dispersion must be attempted by encouraging absorption, for which purpose various infrictions, fomentations, and plasters are recommended. The most efficient remedies, according to my experience, are, repeated cupping or dry cupping, rubbing in mercurial ointment either alone or with caustic ammonia and camphor, iodine ointment, proper pressure with a bandage; in suppuration, continued blisters; corresponding general treatment of the internal cause. I have not seen any particular benefit from moxas, or from the slight scoring with the actual cautery, which has been recommended.

208. If the inflammation run into suppuration on the external surface of the capsular ligament, it must, when fluctuation is distinct, be properly opened; care must be taken for the free flow of the pus, and poultices applied (1). If the suppuration attack the joint itself, and, if the simple local use of poultices and corresponding general treatment do not lead us to hope that anchylosis can be effected; if the symptoms become worse, and hectic consumption be feared, amputation, or, under favourable circumstances, removal of the carious joint ends of the bones, is the only remedy. During the treatment of the inflammation of joints, care must be taken that the

limb should be as much as possible in such position that, if stiffness and anchylosis should happen, it may be the least inconvenient; in the knee-joint, for instance, in a straight posture, but at the elbow-joint half bent (2).

[(1) The suppuration which CHELIUS here mentions, has certainly nothing to do with the ligaments, but is that

"*Disease of the cellular membrane of joints*" spoken of by WICKHAM, which has resemblance, in some respects, to the white swelling described by RUSSELL and NICOLAI, but seems to me on the whole, very different. "Inflammation," says he, "having its seat in the cellular substance, existing as a primary affection of that tissue, and continuing to occupy that part only of the joint, gives birth to a succession of symptoms wholly distinct from those which are the effect of disease, in any other part." It is first indicated by "swelling more or less, according to the situation and extent of the inflammation. If the cellular substance within the joint be affected, and the inflammation be of a chronic character, the swelling is but slight, but if that structure which invests the capsule be attacked, the swelling is very considerable, and the inflammation generally more active in its progress. The first stages of the disease, under all circumstances, are nearly the same, differing only in degree The swelling of the joint is equable and firm, and, as the skin becomes placed on the stretch, grows shining and white: this stage, which may be called the adhesive, will last sometimes for many months, and produce very great irritation on the general system." As the skin stretches more, the sensibility is much quickened, and the patient's sufferings much aggravated, so that "at times he cannot bear the weight of the bed-clothes. * * * The pain, until the arrival of this symptom, is more obtuse, and oftentimes but very slight. The duration of this stage varies very much; but the approach of that which is attended by the suppurative process, is, for the most part, marked by the usual constitutional symptoms indicating the formation of matter, such as rigors and succeeding heat, and general febrile paroxysms, which assume, if the suppuration be large, a hectic character. It sometimes happens that the constitutional disturbance is so great as to require the removal of the limb, and that before any other structure is implicated; but it is more common for inflammation to propagate itself by contiguity to the synovial membrane, and afterwards to the articulating cartilages, when it becomes confused with the peculiar symptoms attendant on disease of those parts." The disease of the cellular membrane appears in two forms: "the one in which a single, or more, spots may have been the seat of the inflammation, having its origin from some injury which the part may have received, and pursuing a chronic course to the formation of small sacs of pus in those situations, which, perhaps, ulcerate through the synovial membrane; the second case is that in which the whole of the cellular membrane, surrounding the articulation, becomes inflamed, and ultimately envelops the joint in one large abscess. The first case is the more common of the two; the latter, the effect of a sudden attack of inflammation, and more active in its course." (p. 84-6.)

In 1839, I amputated the knee of a man, aged twenty-seven years, for disease of the former kind, which had resulted from slipping down stairs and bending his knee under him sixteen months before. The examination of the joint presented a large abscess on the inner condyle of the thigh-bone, which it had flattened and somewhat roughened without laying it bare; another long abscess extending from the knee upwards behind the hamstring, and downward, about three inches, below the head of the fibula; the skin over both abscesses very thin, but neither communicating with the other, nor with an open wound above the outer condyle, the remains of an abscess which had burst five weeks before the operation. Behind the knee, in the popliteal space, was a fourth abscess, large and deep. Neither of the four had any communication with the cavity of the knee-joint, which did not contain any pus, but the synovial membrane, around the knee-cap, was thickened, soft, and jelly-like.

Earlier in the same year I saw a case of the latter kind in a woman who, about a month previous, had received a blow on the inside of the knee; a fortnight after she was attacked with severe shivering, which was followed by much swelling and puffiness about the joint, especially on the inside. A puncture was made just below the knee-cap, and twelve ounces of good pus discharged, but it was requisite to make a second opening two days after, and eight ounces more matter passed out. She did well. In a second case, where I had been attending a lady for many months, with what seemed to me chronic inflammation of the synovial membrane, with large effusion in the cavity of the joint; suppuration occurred some time after, whilst she was in Barbadoes; the abscess was opened, and she did well. Both these cases I, at the time, considered connected with the joint; but the result proved that such could not have been the case.—J. F. S.

(2) **Chelius**'s direction to keep the knee-joint straight, as the most convenient position, when there is a probability of stiffness resulting from the disease with which it is affected, is not at all satisfactory, nor should it be followed, as, thus fixed, it causes considerable halting in the gait, and, preventing the play of the ankle-joint, puts the patient in nearly the same condition as if he wore a wooden leg. And also when he sits down, the limb is obliged to thrust out before him, very inconveniently both to himself and others. The knee should, indeed, from the first of the treatment, be half bent and supported beneath by pillows, as the tendons passing over the joint, and the tendinous expansions connected with its capsule are thereby relaxed; and, if permanent stiffness take place, the bent position is most convenient for sitting; and, in walking, the play of the ankle-joint is so increased that the halting is comparatively trifling, and the patient's movements much more free than if straight. The bent position is obviously best for persons accustomed to ride on horseback. For these reasons, therefore, the bent is preferable to the straight position of the knee and leg.—J. F. S.]

B.—OF INFLAMMATION OF THE SYNOVIAL MEMBRANE.

209. *Inflammation of the Synovial Membrane* (*Inflammatio Membranæ Synovialis*, Lat.; *Entzündung der Synovialhaut*, Germ.; *Inflammation de la Membrane Synoviale*, Fr.) may arise either as a primary disease, or may have extended from other tissues. The synovial membrane is frequently attacked with inflammation on account of its vital relations; it has generally a tedious course, and the functions of the joint are not at the onset entirely destroyed.

[The importance of every circumstance connected with diseases of joints, and the difference of opinion in regard to the special structure in which one or other of them commences, and by which they are sustained, is sufficient warrant for giving some account of their natural structure and condition. And for this reason I shall here notice

The Structure of Synovial Membrane.—The first satisfactory mention of it is that of **William Hunter** (*a*); a careful perusal of which will show that very little has been really added by modern writers to his observations.

"We are told by anatomists," says this able teacher (*b*), "that cartilages are covered with a membrane named *perichondrium*. If they mean the cartilages of the ribs, larynx, ear, &c., there, indeed, such a membrane is very conspicuous; but the *perichondrium* of the smooth articulating cartilages is so fine and firmly traced upon the surface that there is room to doubt whether it has been often demonstrated or rightly understood. This membrane, however, I have raised in pretty large pieces, after macerating, and find it to be a continuation of that fine smooth membrane (the synovial membrane) that lines the capsular ligament, folded over the end of the bone, from where that ligament is inserted. On the neck of the bone, or between the insertion of the ligament and border of the cartilage it is very conspicuous, and may be pulled up with a pair of pincers; but where it covers the cartilage it coheres to it so closely that it is not to be traced in the recent subject without great care and delicacy. In this particular it resembles that membrane which is common to the eyelids and the fore part of the eyeball, and which is loosely connected with the albuginea, but strongly attached to the cornea." (p. 516.)

This observation of **William Hunter**'s in regard to the continuity of the synovial

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(*a*) I am not aware it is generally known that **William Hunter** was not only a surgeon, but also a member of the Court of Assistants of the Corporation of Surgeons of London. I became accidentally acquainted with this fact last year, in looking over the Court Books of the Corporation, where is the following entry:—"1st July, 1756. It having been reported to the Court that Dr. **William Hunter**, a member of this Court, was desirous of being disfranchised on such terms as the Court would agree on, It was Ordered that the clerk do deliver him the instrument of disfranchisement, under the seal of this Corporation, on his paying down forty guineas for the same, being the same terms on which it was granted to Dr. **Wathen**, on the 6th Dec. 1753."—**William Hunter** took the degree of M.D. in the University of Glasgow, 24th October, 1750, and he became a Licentiate of the College of Physicians in London, in the year 1756; but at the time of his writing this, as well as other valuable papers, he was a surgeon; and it is too honourable a distinction for the Corporation of Surgeons to have included amongst its members two such celebrated men as **William** and **John Hunter**, as to pass over without its being distinctly recorded.—J.F.S.

(*b*) Of the Structure and Diseases of Articulating Cartilages; in Philos. Trans. vol. xlii. 1743.

membrane over the cartilage of joints, has been confirmed by Henle (*a*), who says:—"The epithelial layer on the inner surface of the synovial membrane attains a thickness of 0,006‴—0,008‴. Many layers of cells are here observed piled on each other, and the outermost, viz. those next the free surface, are like those in the epidermis of the cutis and mucosa, broad, flat, and of irregular form; their nucleus is not always distinct. The round cells of the synovial membrane have, in the mean, a diameter of 0,004‴—0,005‴, and the oblong cells measure as much in their smallest diameter. The ligaments and cartilages which pass through the cavity of a joint, have a covering of epithelium which is continued in a thin layer upon the joint surfaces of the cartilages, but separated from the cartilage corpuscles by a thin layer of cellular tissue." (p. 116.)

Toynbee (*b*) also states that, "in a fœtal calf, towards the latter part of uterine existence, he had removed the synovial membrane from nearly the entire surface of the articular cartilage of the condyle of the femur, to which it was attached by a considerable layer of cellular tissue in which the blood-vessels are seen to ramify." (p. 167.) These are not, however, as he supposes, the branches of William Hunter's *circulus articuli vasculosus*, which, as we shall hereafter see, are described by him "as creeping around the cartilaginous brim, or *under* the cartilage," for especial reasons; but Toynbee himself properly describes them as "the vessels of the synovial membrane which cover the articular cartilage," and says that "during fœtal and infantile life, previous to the period when the articular cartilages are subject to pressure, the synovial vessels extend over certain portions of them, from which, in childhood and during adult age, owing to the functions of the joints, they are necessarily absent. At the period when the child begins to use the various joints, and subjects them to pressure, these vessels recede, and in adult life they are only found on that margin of articular cartilage which is exempt from the influence of external forces. The arteries which pass between the articular cartilage and the synovial membrane, like those of the fœtus, may be considered as the termination of the articular arteries. At the point where the reflexed become continuous with the articular synovial membrane, it contains large vessels subjacent to it which are numerous and plexiform. Immediately, however, that they enter the cellular web, between the articular cartilage and synovial membrane, they become enlarged and straight, and pass to a greater or less distance over the border of the articular cartilage, forming loops, frequently with considerable dilatations, and becoming finally continuous with the veins. The free surface of adult cartilage appears to be nourished by the *liquor sanguinis* which exudes from these looped and dilated vessels." (pp. 172, 3.) I doubt the correctness of Toynbee's statement of the recession of the vessels when the child begins to use his joints, and consider that the analogy with the conjunctive coat of the eyeball here also holds good, and, as there, under ordinary circumstances, its vessels are not seen, as they then carry only colourless blood, yet under inflammation they appear numerous and loaded with red blood; so also the same condition is that of the vessels of synovial membrane. Before concluding this short notice regarding the synovial membrane, I would mention Clopton Havers' (*c*) opinion, that the "soft parts, found in the sinuses of the bones within the joint, which to the touch seemed vesicular and spongious, and the membrane not only lax, but also unequal, with protuberances of a different figure and magnitude," were, the latter, "truly glandulous, and those soft bodies, glands." He applied to them the name of "glandulæ mucilaginosæ, or the mucilaginous glands." (pp. 188, 89.) After giving an account of their structure and vascularity, he speaks of their form as "various, and accommodated to the sinus or cavity in which they are seated. Some are not only long but broad at their top, and grow narrow towards the top, so as to terminate in an edge; some have a broad basis, and rise into a sort of cone; some are like little ridges, some like a fimbria, some are broad and pretty flat;" and then observes on their situation, that "in general they are so seated that they cannot be injured by a compression from the bones." (pp. 193, 4.) Goodsir (*d*), in referring to them, says:—"I have been in the habit of considering the highly vascular fringes and processes of the synovial membranes as more active in the formation of epithelium, and therefore more closely allied to the secreting organs than other portions of these membranes. If this be the case, Clopton Havers was not mistaken in his ideas regarding the functions of these vascular fringes. They are situated where they cannot interfere

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(*a*) Ueber die Ausbreitung des Epithelium im Menschlichen Körper; in Müller's Archiv. 1838.

(*b*) Researches tending to prove the non-vascularity and the peculiar uniform mode of organization and nutrition of certain animal tissues, viz. Articular Cartilage and the Cartilage of the different classes of Fibro-Cartilage, &c., &c.; in Phil. Trans., 1841.

(*c*) Osteologia Nova; or some New Observations of the Bones, &c. London, 1691. 8vo.

(*d*) On the Structure of the Serous Membranes; in his Anatomical and Pathological Observations. Edinburgh, 1845. 8vo.

with the motions of the joint. They hang into those parts of the cavity best fitted for containing and acting as reservoirs of synovia; and their high vascularity, and the pulpy nature of their serous covering, tend to strengthen this opinion." (pp. 42, 3.)

That **Havers'** opinion is correct as to the function of these vascular fringes, I think there is not a doubt, having had to-day (May 2, 1845) the pleasure of being shown, by my laborious friend **Rainey**, our microscopist at St. Thomas's museum, their minute structure on the synovial membrane of joints and in tendon sheaths, which, he tells me, he made out and showed to our mutual friend **Grainger** at least eighteen months since, although, till the present time, it has not been made public. He demonstrates the vessels contained in the fringes as having a very different disposition from those secreting fat, and, being surrounded by an investment of epithelium, from which it is evident that the old idea of their being the synovial glands is correct, and that the modern notion of their being fat-vessels, held by some physiologists, is incorrect. Moreover, that when the sheath, at least of an adult tendon, is injected, these organs are the only parts which readily receive the injection, and appear like vascular lobules on a whitish ground, the other parts of the sheath scarcely exhibiting any injection.—J. F. S.

"No part of the body," says **Brodie**, "is much more frequently diseased than the synovial membranes. This is what their anatomical structure and functions might lead us to expect, since we find that living organs are more subject to have their natural functions deranged, in proportion as they are more vascular, and as they are employed in a greater degree in the process of secretion." (p. 8.)]

At the beginning the pain is trifling, and, although affecting the whole joint, is more severe at one part. Frequently, however, it is very violent, motion of the joint is impossible, and fever occurs. After some time swelling comes on, which fluctuates differently, according to the form of the joint, and is more evident at those points where the soft parts afford least resistance. If the inflammation be long continued, or recur frequently, the swelling becomes gradually larger and harder, depending on the loosening and hardening of the synovial membrane and ligaments; severe pain, sleeplessness, and hectic fever come on; the swelling bursts at different parts, and the powers of the patient are exhausted. In the most favourable cases anchylosis takes place. If the inflammation be very insidious, and do not go on to loosening of the synovial membrane, it may terminate in dropsy of the joint and weakening of the ligaments; so, when the inflammation specially affects the ligaments, thickening of them, with impeded motion and greater or less bending of the joint, swellings, and knots from deposition of earthy matter, (especially in gouty inflammation,) may occur.

[**Chelius** here considers as one, the two forms of diseased synovial membrane which have been distinguished by **Brodie**; the one as "consisting simply in a morbid action," and the other, or "others, in which the morbid action produces a morbid change of anatomical structure." (p. 76.) The former, arising simply from common inflammation, which may be resolved entirely, or terminate in one or other of the usual consequences of inflammation, or which may degenerate into the second form, in which a specific change of structure takes place. It will, therefore, be necessary to point out these different forms.—J. F. S.

Common inflammation of the synovial membrane may be either acute or chronic, or it may assume the sub-acute form, which is by far the most frequent, and generally passes by the name of chronic inflammation.

As to the comparative occurrence of synovial inflammation, **Brodie** observes:—"Although no period of life is altogether exempt from this disease, it does not occur equally in persons of all ages. It very seldom attacks young children, becomes less rare as they approach the age of puberty, and is very frequent in adult persons. This is the reverse of what happens with respect to some of the other diseases to which the joints are liable, and a knowledge of these circumstances will be found of some importance to the surgeon, in assisting him to form a ready diagnosis." (p. 20.)

Acute synovial inflammation may arise spontaneously, but mostly it results from injury as either blows or wounds. When it occurs, **Brodie** observes, that "the swelling takes place immediately after, or at the same instant, with the first attack of pain; there is redness of the skin; the pain is more severe, and it is so much aggravated by the motion of the parts, that the patient keeps the joint constantly in the same position, and usually in an intermediate state between that of flexion and extension. In addition to these symptoms, there is more or less of symptomatic fever of the inflammatory kind. In a few days, the disease, if left to itself, assumes the chronic form, or, perhaps, under proper treatment, it subsides altogether. It must be observed, however, that the boundaries of acute and chronic inflammation do not admit of being very well defined. These terms accurately enough express the two extremes; but there are numerous intermediate degrees of inflammation, of which it is difficult to determine whether they should be considered as being of the acute or chronic kind." (pp. 31, 2.)

Sometimes the inflammation runs on to *suppuration*, and the constitutional excitement is more or less severe till the pus have either found its way out by ulcerating through the whole wall of the joint, or till it have been discharged by puncture; but in either case it sometimes proves fatal from the disturbance produced. The following are examples:—

CASE 1 is mentioned by BRODIE:—"A young lady, nine years of age, being at play on the first of January, 1808, fell and wrenched her hip; she experienced so little uneasiness that she walked out on that day as usual. In the evening she went to a dance, but while there, was seized with a rigor, was carried home, and put to bed. Next morning she was much indisposed, and complained of pain in the thigh and knee: on the following day she had pain in the hip, and was very feverish. These symptoms continued; she became delirious, and she died just a week from the time of the accident. On inspecting the body on the following day, the viscera of the thorax and abdomen were found in a perfectly healthy state. The hip-joint on the side of the injury contained about half an ounce of dark-coloured pus; and the synovial membrane, where it was reflected over the neck of the former, was destroyed by ulceration for about the extent of a shilling." (pp. 73, 4.) BRODIE mentions this as a case of "ulceration of the synovial membrane, as a primary affection;" but it seems to me rather the result of the pressure of the pus in attempting to produce an outlet. And I think that his other case, in which there was "about half an ounce of thin pus found in the shoulder-joint; and the synovial membrane bore marks of general inflammation, and in one spot where it was reflected over the neck of the *os brachii* was destroyed by ulceration for about the extent of a sixpence," (p. 75,) was under similar though less urgent circumstances.—J. F. S.

CASE 2 is related by WICKHAM, in which the pus was discharged by ulceration, but the girl died. M. C., aged fifteen years, applied to him, "on account of pain which she had for several days experienced in her left knee-joint; at that time it had not been severe, but it was confined to one spot below the patella, and she described it as of a dull aching kind." Leeches, saturnine lotion, and aperient medicine were ordered. Three days after she was "suffering very greatly; the pain was general over the joint, of the tensive character, and the part swollen to nearly double its natural size. The skin over it was hot and shining; the febrile symptoms were very high, and delirium had come on. Six days after, suppuration had established itself; and, after the lapse of eleven days more, "she died without any mitigation of the constitutional disturbance; the sensorium continuing to be affected to the last." (pp. 68, 9.)

CASE 3.—In this instance the abscess was opened, and ultimately did well. In 1836, E. A., a girl of twenty-two years of age, slipped down stairs, and wrenched her knee, but so slightly, that she took no notice of it till a week after, when she had pain at the top of the knee, which increased so much during a single night, that on the following day she was unable to put her foot to the ground, on account of the severity of the pain. She continued suffering severely for three weeks, and then came to the hospital, the girth of her knee being twenty-two inches: fluctuation was very distinct all round the knee-cap; she was free from pain when at rest, but if moved, pain came on, and was increased if the leg hung down. Leeches, blisters, and an issue were employed, but without benefit. The tumefaction increased, and the neighbouring cellular tissue on the thigh became œdematous. She continued during five weeks getting worse, and, the skin thinning, a lancet was passed in, which evacuated eight ounces of pus, and the wound, having been carefully closed, healed up. But the matter continued to form, and the pain increasing, and the joint having acquired its former size, another puncture was made, and half a pint more pus escaped. The wound was left unclosed, the discharge continued, but in the course of a fortnight pain, even on motion ceased, and she slowly recovered.

When the synovial membrane suppurates after wound of the joint, very commonly the whole of its interior is destroyed, and the patient is worn out, unless the limb be amputated; or under favourable circumstances the patient recovers with a stiff joint.

If the acute stage be checked, it sometimes subsides entirely, but at other times the inflammation becomes chronic, or terminates in the effusion of a large quantity of fluid in the cavity.

In the much more frequent *subacute or chronic form*, when "inflammation of the synovial membrane takes place, as a symptom of constitutional affection, where the system is under the influence of gout or rheumatism, &c.," BRODIE says, "in these cases, the disease, for the most part, is not very severe; it occasions a preternatural secretion of synovia, but does not, in general, terminate in the effusion of coagulable lymph, or in thickening of the inflamed membrane. Sometimes it attacks the greater number of the joints at the same instant, and even extends to the synovial membranes, which constitute the *bursæ mucosæ* and sheaths of the tendons. At other times, it leaves one part to attack another, and several joints are affected in succession. In other cases, the disease is entirely local, produced by a sprain, or other injury, or the application of cold, and sometimes arising from no evident cause. * * * Where the inflammation is thus confined to a single joint, it is more probable that it will assume a severe character, and that it may be of long duration. It leaves the joint with its functions more or less impaired, and occasionally terminates in its total destruction. In itself it is a serious disease; but it is often confounded under the alarming name of white swelling, with other diseases, which are still more serious." (pp. 21, 2.)

"The pain," BRODIE observes, "usually continues to increase during the first week or ten days, when it is at its height. Sometimes even at this period the pain is trifling, so that the patient experiences but little inconvenience from it: at other times it is considerable, and every motion of the joint is distressing and difficult. In the course of one or two days after the commencement of the pain, the joint may be observed to be swollen. At first the swelling arises entirely from a preternatural collection of fluid in its cavity. In the superficial joints, the fluid may be distinctly felt to undulate when pressure is made alternately by the two hands placed one on each side. When the inflammation has existed for some time, the fluid is less perceptible than before, in consequence of the synovial membrane having become thickened, or from the effusion of lymph on its inner or outer surface; and, in many cases, where the disease has been of long standing, although the joint is much swollen, and symptoms of inflammation still exist, the fluid in its cavity is scarcely to be felt. As the swelling consists more of solid substance, so the natural mobility of the joint is, in a great degree, impaired." (p. 23–5.)

"Inflammation may attack the synovial membranes in different degrees of intensity; but, for the most part, it has the form of a chronic or slow inflammation, which, while it impairs, does not altogether destroy the functions of the joint; and which, if not relieved, in the first instance, by active and judicious treatment, may, like a chronic ophthalmia, continue for weeks or months, and, with occasional recoveries and relapses, may even harass and torment the patient during several successive years." (p. 23.)

"The form of the swelling deserves notice. It is not that of the articulating ends of the bones, and, therefore, it differs from the natural form of the joint. The swelling arises chiefly from the distended state of the synovial membrane, and hence its figure depends, in great measure, on the situation of the ligaments and tendons, which resist it in certain directions, and allow it to take place in others. Thus, when the knee is affected, the swelling is principally observable on the anterior and lower part of the thigh, under the extensor muscles, where there is only a yielding cellular structure between those muscles and the bone. It is also often considerable in the spaces between the ligament of the patella and the lateral ligaments; the fluid collected in the cavity causing the fatty substance to protrude in this situation, where the resistance of the external parts is less than elsewhere. In the elbow, the swelling is principally observable in the posterior part of the arm, above the olechranon, and under the extensor muscles of the fore arm. And in the ankle, it shows itself on each side, in the space between the lateral ligaments and the tendons, which are situated on the anterior part." (pp. 25, 6.)

"After inflammation of the synovial membrane has subsided, the fluid is absorbed, and, in some instances, the joint regains its natural figure and mobility; but, in other cases, stiffness and swelling remain. Sometimes the swelling has the same peculiar form which it possessed while the inflammation still existed, and while fluid was contained in the joint; and we may suppose that it depends principally on the inner surface of the synovial membrane having a thick lining of coagulable lymph; at other times, the swelling has the form of the articulating extremities of the bones, that is, nearly the natural form of the joint, and it probably arises from the thickened state of the synovial membrane. * * * In those cases where the synovial membrane is thickened, although the fluid which had been effused is absorbed, and the principal swelling has disappeared, it occasionally happens, not only that a certain degree of inflammation still lingers in the part, but that it continues until the morbid action extends to the other textures, and ultimately ulceration takes place in the cartilages, suppuration is established, and there is complete destruction of the articulating surfaces." (p. 28, 9.)

"With respect to the fluctuation," LAWRENCE (*a*) says, "that cases of this kind differ materially. In some instances the tumefaction of the joint is quite soft, and we can very easily detect the fluid: we can move it from one part to another: by pressing on the tumour above, we elevate the patella from its situation, actually lift it up from the trochlea of the os femoris, and then, by pressure upon it, can push it down again into a sort of cavity. In some cases the swelling feels much harder; and there are cases, where the inflammation is violent and has proceeded rapidly, in which the swelling is so firm as to afford but a slight sensation of tumefaction to the hand. I have seen cases which, from the tension produced by the large quantity of fluid, have quite deceived me, and have presented all the characters of a solid tumour. However, on cautiously examining those cases, more particularly if the knee is put as much as possible into the extended state, so as to relax the extensor muscles, you will be able to detect the nature of the tumour, although at first it may give you the impression that it is solid." (p. 480.)

Not very unfrequently, I think, though BRODIE says "not often * * * a joint is swollen from a preternatural quantity of fluid collected in its cavity, without pain or inflammation. This may be supposed to arise, either from a diminished action of the absorbents, or an increased action of the secreting vessels. The disease may be compared to the dropsy of the peritoneum or pleura, or, more properly, to the hydrocele; and it has been not improperly designated by the terms *Hydrarthrus* and *Hydrops Articuli.*" (p. 10.)

Here would seem to be the most convenient place to mention the alleged differences between inflammation of the ligaments, and that of the synovial membrane; and, though the form specially mentioned is that of *rheumatic inflammation*, and it might be more strictly considered to belong to the physician's department, yet, as it is the only attempt made to distinguish between the inflammatory conditions of the two tissues, I shall make no apology for the following long extract from WATSON (*b*):—"There are two varieties of acute rheumatism, a circumstance first noticed by Dr. CHAMBERS at St. George's Hospital, and afterwards made public by Dr. FRANCIS HAWKINS in his Gulstonian Lectures. The varieties are spoken of under the names of *fibrous* or *diffused* rheumatism, and *synovial* rheumatism. I apprehend, however, that in both of them the inflammation has its starting point in some fibrous texture; but that in the one a considerable extent of that texture is implicated, while the inflammation does not involve the neighbouring synovial or serous tissue; and in the other the extent of fibrous tissue affected in the onset is comparatively small, while the local symptoms are more expressive of the secondary synovial disease. I will briefly state the distinctive characters of these two varieties of what is primarily and essentially the same malady. In the one, then, the inflammation commences in the immediate neighbourhood of one of the larger joints; not *in* the joint, but *near* it. It attacks the tendons, fasciæ, ligaments, and possibly also the muscles. There is not, at first, much redness or swelling; but after the pain has been of some duration, there is a puffiness around the parts affected, caused apparently by turgescence of the blood-vessels, and at length slight pitting or *œdema* may supervene, from effusion into the surrounding cellular tissue, and what redness is present is disposed in streaks, following the course of the tendons. On the other hand, in the synovial variety, which shows itself more frequently and more plainly in the knee than any where else, the pain, which marks the onset of the complaint, does not last long before some degree of swelling is perceptible, together, in most instances, with slight redness of the skin; and this swelling is not due so much to turgescence of vessels as to œdema of the cellular tissue, as to fluid poured into the *cavity* of the joint. And the form and character of the swelling indicate that it is the result of the fulness and distension of the synovial membrane; it is tight and elastic, and protrudes, as it were, through the spaces that intervene between the tendons and the ligaments, by which it is in other parts bound down and restrained; and *fluctuation* is often distinctly perceptible in the superficial joints, when both hands are applied to them. These are the *local* differences between the two forms of the disease. And there are differences equally well marked between the constitutional symptoms that attend them. It is in that form which (*κατ' ἐξοχην*) is called *fibrous* rheumatism, that the inflammatory fever runs so high, that the tongue is so thickly furred, that the round full-bounding pulse occurs, that the profuse spontaneous acid perspirations break out, which exhaust the patient's strength without alleviating his sufferings, that the urine is high coloured, and deposits a copious sedi-

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(*a*) Lectures in Lancet, 1829–30, vol. ii.

(*b*) Lectures on Physic, vol. ii.

ment like brickdust. In the *synovial* form, the fever is either less intense from the beginning, or soon moderates, after the joints begin to swell; the tongue is less foul; the patient sweats much less. It is to this form that the term *rheumatic gout* is often applied." (pp. 621, 2.) Of the chronic rheumatism WATSON also mentions two kinds:— "One attended with local heat and swelling, although the constitution at large sympathises very little, or not at all, with the topical inflammation; the other characterized rather by coldness and stiffness of the painful joints. In the former of these, the pains are increased by pressure, and by movements of the limbs, and by external warmth, the warmth of a bed for example; and there may be even some slight degree of pyrexia at night. In truth, this form of chronic rheumatism claims a near relationship with the acute, *into* which it sometimes passes, and *of* which it is frequently the sequel." (pp. 628, 9.)

Gonorrhœal Rheumatism and *Gonorrhœal Ophthalmia* were, I believe, first mentioned publicly by ASTLEY COOPER, and "the first of these affections," he considers, "is not an unfrequent disease;" but it appears to have been previously observed by the elder CLINE; for, in reply to the question put to him by COOPER, Whether he had ever seen rheumatism produced from gonorrhœa? he said:—"Several times." COOPER'S account of the disease is described in his usual homely but graphic manner, in the following, his first

CASE.—"An American gentleman came to me with a gonorrhœa, and, after he had told his story, I smiled and said, 'Do so and so,' particularizing the treatment, and that he would soon be better, but he stopped me and said, 'Not so fast, sir; a gonorrhœa with me is not to be made so light of; it is no trifle; for in a short time you will find me with inflammation in the eyes, and in a few days after I shall have rheumatism in the joints. I do not say this from the experience of one gonorrhœa only but from that of two, and on each occasion I was afflicted in this manner.' I begged him to be careful to prevent any gonorrhœal matter coming in contact with the eye, which he said he would. Three days after this I called on him, and he said, 'Now you may observe what I told you a day or two ago is true.' He had a green shade on, and there was ophthalmia of each eye. * * * In three days more he sent for me rather earlier than usual, for a pain in his left knee; it was stiff and inflamed. I ordered some applications and soon after the right knee became affected in a similar manner. The ophthalmia was with great difficulty cured, and the rheumatism continued many weeks afterwards. * * * Whether it is by absorption of the poison or the constant irritation produced by the inflammation of the urethra, I do not know; but certain it is that gonorrhœa produces ophthalmia and rheumatism, and when not a single drop of matter has been applied to the eye. The inflammation generally attacks both eyes and is of long duration." (pp. 273, 4.)

BRODIE also speaks of cases of inflamed synovial membrane after gonorrhœa; these were in every instance accompanied with purulent ophthalmia, which, in most, but not in all, preceded the affection of the joints, which recurred often, again and again; and in one case the joint was affected nine times.

For our knowledge of that form of diseased synovial membrane, which may be called *pulpy degeneration*, we are indebted to BRODIE, who describes it as consisting "in a morbid alteration of structure, which takes place in the synovial membranes of joints, and which, as far as I have seen, is peculiar to these parts. I have never known an instance of the same diseases in the serous membranes, which so nearly resemble the former in their nature and functions; nor even in the synovial membranes that constitute the bursæ mucosæ and sheaths of the tendons." (p. 77.) The disease seems to commence in the reflected portions of the synovial membrane, converting them into a light brown pulpy substance, varying from a quarter to a half, or even a whole inch in thickness, intersected with white membranous lines and red spots, formed by small vessels injected with their own blood. It then attacks the synovial membrane, which over-spreads tke cartilaginous covering of the ends of the bones, beginning at their edge and extending gradually over them, ulceration in those cartilages going on correspondently, till the carious or ulcerating surfaces of the bone are exposed. The cavity of the joint sometimes contains pale yellow fluid in the floating flakes of lymph, or pus, which is discharged externally by ulceration; but sometimes neither. Or abscesses may exist in the altered synovial membrane itself, without communication in the joint. LAWRENCE says, that "the ligaments, perhaps, are free from disease, and so, perhaps, are the cartilages; at all events, if either are affected, it will be the cartilages:" (p. 482:) on this point, therefore, he does not agree with BRODIE. The latter author considers that this disease "belongs to the same order with tubercles of the lungs, scirrhus of the breast, the medullary sarcoma or fungus hæmatodes of the testicle, and numerous other diseases, in which the natural structure of the affected organ is destroyed, and a new and different structure is added in its place. To these also it bears a near resemblance in its progress. Thus tubercles of the lungs, in the first instance, occupy the vesicular and interlobular substance; but ultimately they inflame and ulcerate, abscesses form in them, and the pleura, the bronchia, and other contiguous parts become affected. * * * In every case in which I have had it in my power to watch its progress, the complaint has advanced slowly, and sometimes has remained in an indolent state during a very long period, but ultimately it has always terminated in the destruction of the joint. It is a remarkable circumstance that this affection of the synovial membrane is rarely met with, except in the knee. I have never known an instance of it in the hip or shoulder. But Hodgson of Birmingham informs me he has met with one example in the ankle, and another in one of the joints of a finger." (p. 95–7.)

If by placing this disease in "the same order with tubercles of the lungs, scirrhus of the breast," &c., Brodie means to infer that it is malignant in the usual acceptation of the term, I must differ from him, as I am not aware that it presents itself in any other organ of the body, and, indeed, he himself observes, "it is a remarkable circumstance that this affection of the synovial membrane is rarely met with except in the knee." It destroys life, indeed, if the limb be not removed; but only in the same way as other causes by which the surface of the joint is destroyed and either opened or not, by wearing out the powers of the constitution.— J. F. S.

"This disease," according to Brodie, "generally takes place in persons who are not much above the age of puberty. I do not recollect," says he, "one instance of it having occurred after the middle period of life. In general it can be traced to no evident cause; but occasionally it is the consequence of repeated attacks of inflammation. In this respect it resembles other diseases of the same order. Inflammation of the lungs may lay the foundation of tubercles, and inflammation of the breast may occasion the growth of a scirrhous tumour. * * * In the origin of this disease there is a slight degree of stiffness and tumefaction, without pain, and producing only the most trifling inconvenience. These symptoms gradually increase. In the greater number of cases, the joint at last scarcely admits of the smallest motion; but, in a few cases, it always retains a certain degree of mobility. The form of the swelling bears some resemblance to that in cases of inflammation of the synovial membrane, but it is less regular. The swelling is soft and elastic, and gives to the hand a sensation as if it contained fluid. If only one hand be employed in making the examination, the deception may be complete, and the most experienced surgeon may be led to suppose that there is fluid in the joint when there is none; but, if both hands be employed, one on each side, the absence of fluid is distinguished by the want of fluctuation. The patient experiences little or no pain until abscesses begin to form and the cartilages ulcerate; and, even then, the pain is, in many instances, not so severe as where the ulceration of the cartilages occurs as a primary disease, and the abscesses heal more readily, and discharge a smaller quantity of pus, than in cases of this last description. At this period the patient becomes affected with hectic fever, loses his flesh, and gradually sinks, unless the limb be removed by an operation. * * * The gradual progress of the enlargement and stiffness of the joint without pain, and the soft elastic swelling without fluctuation, in the majority of cases, enables us to distinguish it readily from all the other morbid affections to which the joints are liable. The cases with which those of this disease are most liable to be confounded are those of chronic inflammation of the synovial membrane. *Firstly.* When the synovial membrane has undergone a morbid change of structure, it occasionally happens that a preternatural secretion of fluid takes place at the same time from its inner surface, and the joint becomes distended, not with synovia, but with a turbid serum, having flakes of coagulable lymph floating in it, which causes the tumour to present nearly the same external characters as where synovial membrane is inflamed." But Brodie distinguishes it by its not yielding to the ordinary treatment, and by the accurate previous history. "*Secondly.* When the synovial membrane, after inflammation has subsided, has been left in a thickened state, and coagulable lymph has been effused into the articular cavity, the tumour, in some instances, a good deal resembles the tumour which occurs in cases of this disease; so much so, that it will be very difficult to give a correct opinion merely from observing the present appearance and condition of the joint. The surgeon must, in great measure, form his judgment from the account which he receives of the origin and early symptoms of the complaint, or, when an accurate statement cannot be procured, by waiting to observe its future progress." (p. 101–6.)]

210. The examination of the joint after death shows, in a milder form of the disease, the synovial membrane inflamed, and the cavity of the joint

filled with a thin, often reddish, fluid (1). In a more advanced state, thickening of the ligaments, swelling of the synovial membrane into a fungous fleshy-like mass penetrated with white streaks, often with a mass beset with polypous or hydatid-like growths, a collection of yellowish lymph mixed with white flakes (2); finally, destruction of the cartilages and caries of the joint ends of the bones (3).

[(1) This is the result of simple inflammation. BRODIE mentions one excellent example, in which, "throughout the whole of its internal surface, except where it covered the cartilages, the synovial membrane was of a dark-red colour; the vessels being as numerous and as much distended with blood as those of the *tunica conjunctiva* of the eye in a violent ophthalmia." (p. 12.) In another case—"the synovial membrane was increased in thickness about one-eighth of an inch, and was of a gristly texture." (p. 14.) The former patient had died of fever, independent of the disease in the knee-joint; and the limb of the latter was removed for some other complaint. These are highly important cases, as opportunities for examining inflamed synovial membrane in this, its primary condition, are very rare.

(2) This is the pulpy degeneration described by BRODIE.

(3) This appears to me the form of joint disease described by KEY (*a*), in which "the cartilage is not absorbed *per se*, but through the agency of a structure probably evolved for the special purpose of completing that process," (p. 134,) or, as he elsewhere (*b*) expresses it, a "highly vascular fringe of (synovial) membrane, which is a newly organized, and, in some parts, a superadded structure for the purpose of producing ulceration of the contiguous cartilage." (p. 224.) I fully concur with the correctness of KEY's views upon this point, having seen the condition he describes again and again. But it will be more convenient to consider the subject in connexion with true ulceration of cartilage, a little further on.—J. F. S.]

211. The inflammation of the synovial membrane occurs very readily in superficial joints, especially in the knee-joint, from mechanical violence, cold, rheumatism, gout, gonorrhœa, syphilis, or improper use of mercury. It takes place frequently in several joints at once, or in one after another. When arising from some marked internal cause, the course of this inflammation is usually tedious.

212. The prognosis is more favourable when the disease is consequent to external than when it depends on internal causes. At first it can be dispersed by proper treatment; subsequently, when a collection of fluid has taken place, the resolution is only slowly brought about, and there remains for a long while, and often permanently, a swelling of the joint. If the synovial membrane and the ligaments be much thickened or ulcerated, the cartilages and bones affected, and openings of abscesses present, anchylosis must be considered the most favourable termination: in the majority of cases, however, the removal of the joint is the only remedy.

213. The *treatment* is guided by the causes and degree of the inflammation. If the affection of the joint be connected with general disease, the plan of cure must be directed towards it. In rheumatism and gout especially, *vin. sem. colch.*; in scrofula, cod-liver oil; in gonorrhœa and syphilis, ZITTMANN's decoction. In more severe degrees of inflammation, general, but especially repeated local blood-letting with leeches, and cold fomentations with lead wash are required; but warm fomentations or soothing poultices when the swelling is considerable. When the course of the inflammation is slow, cupping at the commencement is sufficient.

[As regards the local treatment of simple acute inflammation of the synovial membrane, BRODIE says, "If the swelling has rapidly risen to such a height as to occasion considerable tension of the soft parts, the pain will be best relieved by means of warm fomentations and poultices; but otherwise cold evaporating lotions seem to produce a

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(*a*) Med.-Chir. Trans., vol. xix.

(*b*) Med.-Chir. Trans., vol, xviii.

better effect." (p. 35.) I must confess in these cases I prefer warm poultices, either of bread or chamomile flowers, or hot flannels frequently reapplied: the warmth having appeared to me most soothing in the majority of cases. But, as sometimes cold, sometimes heat, affords ease to patients of different constitutions, their feelings must be attended to, and either treatment, found most agreeable, continued. The subacute inflammation requires leeching more frequently, and sometimes cupping; but I think leeches are preferable, as the wounds they make often excite a little erythematous inflammation on the skin, which acts as a gentle diversion. Warm applications here also seem to me preferable to cold. Blisters should not generally be employed till blood has been taken from the part twice or thrice, and the tenderness is either subsiding or has subsided. But sometimes they may be needed earlier if the constitution be weakly and the patient cannot bear the loss of blood.

If the simple acute inflammation of the synovial membrane terminate, as it sometimes does, in suppuration, the swelling should be punctured and the pus discharged as soon as it points, or, perhaps, even before, as the severity of the constitutional excitement will lead to a tolerably sure diagnosis of its existence. The longer it is retained the more does the constitution suffer, and the greater is the liability of ulceration of the membrane and cartilages. There is but a choice of evils, and that of opening the joint seems, to me, less than that of the continued confinement of the pus. I do not think blisters in this case are of much use.—J. F. S.]

214. When the inflammatory stage has passed, but the swelling (from effusion of fluid into the joint) continues, the dispersion is to be encouraged by blisters, repeated around the whole joint, or applied in the neighbourhood, or kept open for some sufficient time with savine cerate; by rubbing in mercurial ointment with camphor and caustic ammonia, by application of solution of acetate of ammonia, by stimulating and dispersing plasters, as *emp. ammon. c. acet. scill.*, and so on. The stiffness in the joint, which often is long continued, may be removed by rubbings with volatile substances, by baths, douche, and careful motion.

[For the removal of fluid in the joint I believe that blisters are the most efficient remedy we can employ; but I do not like blistering the whole joint at once, nor dressing blisters with savine ointment, as, in the one case, independent of strangury which is sometimes excited, and is very annoying as well as painful, it is requisite to wait till the sore is healed before a second application can be made; and, as regards the savine ointment, the pain it causes, if properly applied, (*i. e.*, immediately to the cutis, the cuticle having been previously removed,) is extremely severe, and, as I think, not warrantable by the benefit obtained. I therefore prefer the employment of repeated blisters, two at a time, each about as large as a crown-piece, one above and the other below and on opposite sides of the joint, applied on the alternate parts every third day, by which time, generally, the first applied blisters are beginning to heal, if, immediately after they have risen, they be punctured, and either poulticed or dressed with simple ointment. In this way a constant diversion on the skin may be kept up to an almost unlimited period, with little actual inconvenience to the patient, but with remarkable benefit to his joint. Or, each side of the joint may be alternately blistered, and, the cuticle having been removed, may be dressed with the ointment of iodide of potass, a drachm to the ounce, which is often very efficacious.—J. F. S.

In reference to friction, which was formerly more in vogue than at present, and, if properly employed, is very useful in cases of stiffness after the absorption of the fluid, Brodie very justly observes:—"It should be employed with caution, as, when used too freely, it sometimes occasions a return of the inflammation. Whenever there is the slightest indication of this being the case the friction should be omitted, blood should be taken from the part, and some time should elapse before the friction is resumed. It is sometimes productive of very essential benefit, but not unless it be employed to a considerable extent, as for two or three hours daily, and during a long period of time." He also mentions having "sometimes tried the effect of pumping hot water on a stiff joint, as recommended by Le Dran, and now practised at some watering-places. The blow of a column of water, falling from a height of several feet, produces considerable friction, even so as to excoriate the surface, with which are combined the relaxing powers of heat and moisture. This practice is certainly productive of benefit; but the observations just made apply to this as well as the other modes of producing friction." (p. 40–42.)]

215. If there be already thickened synovial membrane, and, if the acute have passed into the chronic condition, leeches must be repeatedly applied, but in small numbers, waiting, however, each time till the erysipelas thereby excited has subsided. If the swelling be soft, light compression may be employed, mercurial or iodine ointment used; continued derivation by blisters and issues, and moxas or the actual cautery applied (1).

When suppuration occurs in the joint, with destruction of the cartilages and bones, care must be taken for the proper discharge of the pus (2); the limb must be kept in the most perfect rest; the powers supported by the use of tonic remedies, and a proper attention to diet; and poulticing must be continued. If exhaustion be feared, the removal of the limb is indicated.

[(1) When the inflammation has become actually chronic, especially if there be thicking, then irritating applications are especially beneficial. In the milder form soap liniment, either alone, or rendered more stimulating by the addition of *liquor ammoniæ*, or *tinctura lyttæ*, in proportion of a drachm to the ounce, the liniment of ammonia, with oil of turpentine, as recommended by Brodie, or mustard liniment, made by macerating an ounce of mustard flour in a pint of spirit of turpentine, are often sufficient. When more active excitement is necessary, friction with croton oil, about a dozen or twenty drops every evening till it brings out little blisters, which soon run into suppuration, is very serviceable, and a very cleanly application. Brodie recommends a liniment consisting of *ol. olivæ* ℥jss., *ad. acid. sulph.* ʒss.; but, if the patient's skin be delicate, or very tender, less acid must be used; it excites some degree of inflammation of the skin, and the cuticle browns, and is thrown off in thick broad scales. Some persons paint the whole joint over with tincture of iodine, which often acts like a blister. Mercurial ointment, with or without camphor, is frequently used, or ointment of iodide of lead; these are best applied upon lint without rubbing, as the former, if rubbed, often causes ptyalism in delicate persons especially, and the latter soon irritates the skin so much, that its discontinuance is compelled. The use of pressure, with straps of soap plaster, is often very comfortable and beneficial, and may be combined with stimulation of the skin, by using *emp. thur. comp.*, *emp. ammon. c. hydr.*, or *emp. picis Burg.* Tartarized antimonial liniment was a favourite remedy of Astley Cooper's; but it requires to be used with great caution, as, in persons with delicate skin, it often very speedily excites violent inflammation, with a very large crop of pustules, which become extremely painful, and often degenerate into deep and tiresome sores.

(2) The puncture of a joint when fluctuation is accompanied with other symptoms which lead to the presumption of pus being confined in its cavity is, though highly necessary if there be much constitutional excitement, and specially if the abscess point, not always unattended with inconvenience or even danger, and not certainly beneficial to the patient, of which the following is an instance:

Case.—J. P., aged twenty-five years, a baker, came under my care in the year 1843. Three months after having had typhus fever four years and a half since, his right knee became weak, and he began to limp; at this time there was not any swelling of the joint, but during the following six months the knee swelled, and he was under medical treatment; an abscess formed below the knee-cap, and burst subsequently by two wounds below and on the inside of the tubercle of the shin-bone. A discharge continued for four or five months, during which he followed his business, and walked about a good deal. The wounds at last healed, but soon after swelling occurred below and around the knee-cap, and thirteen months since it suppurated, and continued discharging on the apex of the knee-cap till the beginning of April in this year. During nearly the whole of this time he has walked, though not without pain, but has been unable to follow his business. The discharge having ceased, general swelling of the whole knee commenced, and he began to feel weakness on the sides of the joint. Being thus again crippled he came into the hospital

May 2, and I presume (for I did not make any note of his case at the time) I then considered his case as chronic inflammation of the synovial membrane, as he was treated by repeatedly blistering the joint, but the disease has not been at all checked. It is only however, within a fortnight from the present time (*Aug.* 19) that I have begun to think very seriously of his condition. During this time his sleep has been disturbed by shooting pain on the outside of the knee, the pain extending down the leg, always coming on as he falls asleep, and rousing him completely. Latterly he has lost flesh; his pulse is small and quick; but he does not sweat much, and his appetite is good.

The joint is now a good deal swollen and fluctuating, especially above the base of the knee-cap, and on the condyles of the thigh-bone, and less distinctly below the former bone. It is tender on pressure about the middle of the joint on the outside, and above the knee-cap on the inside. He has great pain on the slightest motion: pain on striking up the leg; and on pressing the articulating surfaces together, and twisting the leg upon the thigh causes severe pain; but no grating of the bones can be felt, though perhaps it might be, were not the movement of the limb so painful as to forbid persisting in attempts to ascertain it.

As I felt pretty confident that the joint contained pus, I determined, although it did not point, to evacuate it, and try if it were possible to bring about anchylosis by keeping the parts perfectly quiet, and establishing issues to promote a diversion of the irritation of the joint. And therefore in the afternoon of this day,

Aug. 19. Made a puncture with an abscess lancet on the outside of the base of the knee-cap, where the skin was thinnest. Blood flowed rather freely (about two ounces) at first, but on introducing a director about an ounce of synovial fluid escaped. As no pus appeared, and as the director did not give the sensation of touching any articular surface, I presumed I had only opened the bursa above the knee-cap, and thought it best to close the wound and obtain adhesion as soon as possible, by bringing the edges together with adhesive plaister; for although blood continued flowing from between the lips of the wound, I expected the slight pressure would stop it. The tension was diminished, and the patient was relieved from pain on the inside of the knee immediately on the discharge. Shortly after the wound had been brought together the knee began to swell again and feel distended, and in about a quarter of an hour or twenty minutes the oozing of blood, which had been rather free, was converted into a stream, which flowed freely, and was checked partially by pressure on the artery at the hip-joint, but still the bleeding continued for some time, and he lost twenty-six ounces of blood, when he became very faint. The swelling of the knee, which had been at first very hard gradually diminished and softened as the blood flowed. A tourniquet was applied high up, and the bleeding completely arrested. But he had become so faint and his pulse so weak and fluttering, that it was necessary to give him five ounces of wine and four ounces of brandy before he could be brought round.

Two hours after. I saw him again; he had then rallied, but was still very pale, and his pulse small, weak, and quick. The swelling of the knee, however, being soft, and no hæmorrhage having recurred, the tourniquet was removed, and an evaporating lotion applied to the knee.

I presumed that the bleeding depended entirely on the increased vascularity of the synovial membrane, and not from wound of either of the articular arteries, which, however, might have been the cause. The almost immediate recurrence of the swelling is accounted for by the closure of the wound preventing the external escape of the flowing blood, which was therefore retained in the synovial cavity. No further bleeding occurred; but as his health continued failing, it was determined to amputate the knee, which I did, and he recovered.

On examining the joint, the whole of the synovial membrane lining the capsular and extending over the other ligaments of the joint was found covered with a vascular, thick, soft, and granular substance. The cartilage on the edge of the patella was partially absorbed, as also that on the left articular cavity of the head of the tibia in a semi-circular form, and on both condyles of the thigh-bone it was partially removed, these corresponded to the granular substance on the synovial membrane; and a groove on the cartilage of the internal condyle answered to a remarkable slip of the granular substance, which crossed between and connected the capsular and crucial ligaments. There was not any pus on the joint; but the wound by which the lancet had entered, as it proved to have done, was distinct.—J. F. S.]

C.—OF INFLAMMATION OF THE CARTILAGES.

216. The joint-cartilages may be the primary seat of inflammation (*Inflammatio Cartilaginum*, Lat.; *Entzündung der Knorpel*, Germ.; *Inflammation des Cartilages*, Fr.) and ulceration, which may thence be propagated over the other structures of the joint.

[Before considering the effects of inflammation, and its results on cartilage, it will be well to take a view of the opinions which have been, and are, held as regards its vascularity or non-vascularity, not only on account of the difference of opinion there is upon these points whilst cartilage is in a healthy state, and during its growth, but, also, because upon one or other of these views are founded the different opinions held in reference to their activity or passiveness in the production of the diseases with which they are affected.

Structure of Cartilage.—WILLIAM HUNTER (*a*) examined articular cartilages previously prepared by boiling, or long-continued maceration, and thus describes them :—" When an articular cartilage is well prepared it feels soft, yields to the touch, but restores itself to its former equality of surface when the pressure is taken off. This surface, when viewed through a glass, appears like a piece of velvet. If we endeavour to peel the cartilage off in lamellæ, we find it impracticable, but if we use a certain degree of force, it separates from the bone in small parcels, and we never find the edge of the remaining part oblique, but always perpendicular to the subjacent surface of the bone. If we view this edge through a glass, it appears like the edge of velvet, a mass of short and nearly parallel fibres rising from the bone, and terminating at the external surface of the cartilage; and the bone itself is planned out into small circular dimples where the little bundles of the cartilaginous fibres were fixed. Thus we may compare the texture of cartilage to the pile of velvet, its fibres rising up from the bone, as the silky threads of that rise from the woven cloth or basis. In both substances the short threads sink and bend upon being compressed, but by the power of elasticity recover their perpendicular bearing as soon as they are no longer subjected to a compressing force. * * * Now these perpendicular fibres make the greatest part of the cartilaginous substance; but, without doubt, there are, likewise, transverse fibrils which connect them, and make the whole a solid body, though these last are not easily seen, because, being very tender, they are destroyed in preparing the cartilage. * * * The blood-vessels are so small that they do not admit the red globules of the blood; so that they remained in a great measure unknown till the art of filling the vascular system with a liquid wax brought them to light. Nor even by this method are we able, in adult subjects, to demonstrate the vessels of the true cartilaginous substance; the fat-glands and ligaments shall be red with injected vessels, while not one coloured speck appears upon the cartilage itself. In very young subjects, after a subtle injection, they are very obvious; and I have found their course to be as follows: all round the neck of the bone there are a great number of arteries and veins which ramify into smaller branches, and communicate with one another by frequent anastomoses like those of the mesentery. This might be called the *circulus articuli vasculosus*, the vascular border of the joint. The small branches divide into still smaller ones upon the adjoining surface in their progress towards the centre of the cartilage. We are very seldom able to trace them into its substance, because they terminate abruptly at the edge of the cartilage, like the vessels on the *albuginea oculi*, when they come to the *cornea*. The larger vessels which compose the vascular circle, plunge in by a great number of small holes, and disperse themselves into branches between the cartilage and bone. From these again there arises a crop of small short twigs, that shoot towards the outer surface; and whether they serve for nourishing only, or if they pour out a dewy fluid, I shall not pretend to determine. However that be, I cannot help observing that the distribution of the blood-vessels to the articulating cartilages is very peculiar, and seems calculated for obviating great inconveniences. Had they run on the outer surface, the pressure and motion of the two cartilages must infallibly have occasioned frequent obstructions, inflammations, &c., which would soon have rendered our motions painful, and at last entirely deprived us of them. But by creeping round the cartilaginous brim, where there is little friction, or under the cartilage, where there is none, they are perfectly well defended from such accidents. It were to be wished we could trace the nerves of cartilages: but, in relation to these organs, here, as in many other parts of the body, we are under a necessity, from the imperfection of our senses, of being satisfied with mere conjecture; and though, from the great insensibility of a cartilage, some have doubt of its being furnished with nerves; yet, as it is generally allowed, that these are a *sine quâ non* in the growth and nourishment of animals, we have no sufficient reason to deny their existence in this particular part. With regard to the manner of their distribution, we may presume, from analogy, that they follow the same course with the blood-vessels." (p. 515–19.)

MIESCHER (*b*) says there is not the least difference between permanent cartilage and that which is to be converted into bone. (p. 15.) His observations in regard to articular cartilages do not, however, agree with WILLIAM HUNTER's as regards their actual fibrous structure. He observes:—" When articular cartilages have been thrown for some time into acid, they can easily be separated from the other cartilage which was

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(*a*) Above cited.

(*b*) De Inflammatione Ossium eorumque Anatome generali. Berolini, 1836. 4to.

bony. They are more easily split transversely than in any other direction, their broken surface presents a fibrous appearance, but when placed under the microscope forthwith lose it, and exhibit none other than a regular pellucid substance with ovate corpuscles. These are ranged in the manner of clusters; their longitudinal diameter is situated transversely, as is very distinctly perceived in the thick cartilage covering the joint surface of the knee-cap. On the corpuscles being thus arranged depends the fibrous appearance." (p. 25.)

Todd and Bowman (*a*), however, consider there is a difference between temporary and articular cartilage. In the latter "the cells are oval or roundish, often disposed in small sets of two, three, or four, irregularly disseminated through a nearly homogeneous matrix which is more abundant than in the former." This, however, is in reality all the difference which even they point out, as although they say "in the inner part of the cartilages of incrustation (a term applied to articular cartilages by some anatomists) we usually find the cells assuming more or less of a linear direction and pointing towards the surface, which arrangement is probably connected with a corresponding peculiarity of texture of the intercellular substance, but which it is more difficult to distinguish; for these specimens have a disposition to fracture in a regular manner along planes vertical to the surface, and the broken surface is striated in the same direction." Yet had they previously stated, in reference to temporary cartilage, "When ossification begins, the cells which hitherto were scattered without definite arrangement become disposed in clusters or rows, (Miescher's exact expression *corpuscula racemorum in modum consita*,) the ends of which are directed towards the ossifying part." (p. 90.)

The fibrous structure of articular cartilage as described by William Hunter is explained in the following way by Henle (*b*):—"I have sometimes observed," says he, "the contour of the cavities projecting from one longitudinal row of cavities (in the cartilage) to the next, and it appeared as if a part of the cavity together with the enclosed cells were separated by a cleft. It is, however, possible that these are the hollow parts of one system of long canals which twisted, or perhaps also in rare cases divided angularly, penetrate the cartilage from its lower towards its upper surface, and remain in the cleft partially in the one and partly in the other segment. By this formation is satisfactorily explained why the articular cartilage presents a fibrous fractured surface, and seemed to the old observers to consist of fibres which ran perpendicularly through its thickness. Next the free surface they are more lamellar and can be separated into delicate plates (Meckauer). The flattened cells of this layer have the closest resemblance with the epithelial cells of the synovial membrane and often subside imperceptibly into it; but usually a layer of connecting tissue forms the boundary between them." (p. 796.)

"Most cartilages," says Henle, "are devoid of vessels. The joint-cartilages at their adhering surface are in contact with the very vascular bones, at their free surface they are overspread with synovial membrane; in the connecting tissue of which, however, in the newly born child, and sometimes even in the adult, vessels pass from the edge, and are rendered apparent by injection. Perhaps they originally cover the entire surface and subsequently are obliterated towards the edge from which they are reflected out of the synovial membrane upon the capsular ligament. But in the adult no branches either from the bone or from the synovial membrane penetrate into the cartilage." (pp. 802, 3.)

"The cartilaginous covering of joints is not at first separate from that part of the bone cartilage which will be ossified. During the period of ossification there is a considerable layer of vessels between the cartilage and the already perfectly ossified parts, and it is easy to separate the two parts" (as already stated by Hunter.) "Both have irregular surfaces, elevations, and depressions, by which they hold together. In proportion as ossification extends towards the epiphysis, the vascular layer shrinks and the adhesion becomes more intimate. In newly-born children, however, pretty wide but only slightly branching canals with blood-vessels from without, and from the surface, covered with synovial membrane, penetrate the cartilage deep enough to reach the epiphysal cartilage. * * * When the formation of cartilage is completed, the vessels retract from it, and in the adult its nutrition seems derived only from the vessels of the adjacent bone and perichondrium, perhaps in the joint cartilages also mediately from the synovia which comes from the vessels of the synovial membrane, and the so-called Haverschian glands. The taking up of the plasma thus follows by saturation and thereto seems the special use of the cavities of cartilage. * * * Macerated cartilage is often distinctly

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(*a*) Physiological Anatomy and Physiology of Man, chap. iv. London, 1843. 8vo.

(*b*) Allgemeine Anatomie. Lehre von den Mischungs und Formbestandtheilen des menschlichen Körpers. Leipzig, 1841. 8vo.

reddened by imbibition of the red colour of the blood, and the reddening is greater, the more the cells proportionally exceed the basement; most distinctly therefore in fœtal cartilage. If the blood in the living body carry unnatural colouring substances, as for instance the bile pigment, it penetrates the cartilage, which, therefore, in jaundice, becomes yellow, as noticed by BICHAT." (pp. 808, 9.)

TOYNBEE (*a*) observes, in reference to articular cartilage:—"Although they are properly considered as non-vascular tissues, they appear to be pervaded by blood-vessels at an early period of their development, or, perhaps, it would be more correct to say, that as growth proceeds, the cartilage increases, so as to occupy the space that had previously been permeated by vessels. I have been able," he continues, "to demonstrate that vessels are never found within these cartilages when fully developed; but at that period vessels form convolutions in their immediate vicinity. These vessels are separated from articular cartilage, at adult age, by a layer of bone; and in fibro-cartilage, at the same period, they uniformly terminate within the boundary of its fibrous tissue. Over a certain portion of the free surface of both these tissues blood-vessels extend, but they do not penetrate into their substance. The investigations which are about to be detailed lead, I think, to the certain conclusion, that articular cartilage in the adult state is principally nourished by fluid derived from the vessels of the cancelli of the bone to which it is attached, which exudes through the coats of those vessels, and makes its way into the substance of the cartilage through the intermediate lamella of bone. The cartilage of fibro-cartilage is nourished, in like manner, by *liquor sanguinis*, derived from vessels situated in the contiguous fibrous portion. The vessels ramifying in a certain extent of the free synovial surface of both these species of cartilage, contribute, doubtless, to their nutrition, but not to near the same extent as do the vessels of the opposite side. With respect to the actual process of nutrition, I shall only observe here, that the cells of these structures must be regarded as having the function which has been ascribed to those of all non-vascular tissues, viz., that of promoting the circulation of and modifying the nutrient liquor. In connexion with this process, however, it will be seen that articular cartilage presents, in its adult state, very minute canals, which may be regarded as existing for the reception of the nutrient fluid, and for its circulation through the mass of cartilage; their presence is especially required in this particular form of cartilaginous structure, from the great degree of density which it possesses. * * * The portion of bone upon which articular cartilage rests is, in some instances, formed by the ossification of a distinct cartilaginous epiphysis. In non-epiphysal bones, the extremity of the shaft of the bone performs the same functions with regard to the articular cartilage situated upon it as do the epiphyses in those bones which are provided with them. There is this difference in articular cartilage, with regard to its nutrition during and after its development, that in the former state there is no positive separation of it from the cartilage which is subsequently converted into bone, and in which its nourishing vessels are contained; whilst, in the latter state, these vessels are separated from it by an osseous lamella. The free surface of articular cartilage during, as well as after, its development, is covered by synovial membrane, to which it is attached by cellular membrane." (pp. 162, 3.)

TOYNBEE concludes, from examinations he has made, "that during the most early periods, the cartilage of the epiphysal extremities of bones does not contain any blood-vessels, and that, notwithstanding their absence, the cells of this cartilage are developed, and its growth carried on; and that, at the same time, the cells of the epiphysal and the articular cartilage are formed and developed without the presence of vessels;" and "that, at the more early period of fœtal development, the synovial surface of cartilage does not contain blood-vessels." (pp. 164, 5.)

According to the same observer, in the second stage of development the epiphysal cartilage "presents, except at its articular surface, numerous depressions of various depths. The deepest may be regarded as canals, some of which are single, others bifid; they terminate in blind sacs. The direction of some of these canals is towards the centre of the epiphysis, of others towards its point of attachment to the osseous shaft, and of others towards the articular cartilage. Some of these canals are of a large size, and are frequently considerably dilated at their blind extremities. They do not penetrate into the substance of the articular cartilage; they are for the reception of branches of sanguiferous vessels. When the epiphysis is minutely injected, the depressions upon its surface will be found to contain congeries of convoluted vessels, which are more drawn out the deeper the depression, until at length, in the interior of the canals and their divisions, single and nearly straight vessels are found. These epiphysal vessels have a very peculiar disposition. They consist of an artery having a course more or less

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(*a*) Already cited.

straight, which terminates in a dilatation, or in convoluted branches, from which the vein arises. From the fact of the presence of these vessels, which converge towards, and form convolutions internal to the articular cartilage, it may be inferred that they supply the cells of the latter with a nutrient fluid. As the articular cartilage increases in thickness, and the ossific nucleus which is developed in the epiphysal cartilage becomes larger, these vessels gradually recede from between them, and leave a considerable mass of non-vascular cartilage between the osseous nucleus and the synovial membrane; all of this appears to be articular cartilage, which is now nourished by the vessels in the interior of the nucleus. The supply of blood-vessels in the cancelli of the osseous nucleus is remarkably abundant; they are large, and are separated from the surrounding cartilage by an extremely delicate lamina of bone, which is principally made up of osseous cells. I am induced to believe that at this stage of development, as in adult age, the fluid passes from the bone into the cartilage and nourishes it. * * * The articular cartilage, at this early period of life, is thicker than in the adult state. Although devoid of canals for the reception of blood-vessels, it presents numerous minute canals, which pervade that portion of it contiguous to the osseous nucleus, and they course from the latter towards the synovial membrane, which, however, they do not reach. * * * They are minute, and extremely numerous; they divide, sub-divide, and communicate with each other, and form dilatations. The parietes of these canals present distinct rounded cells, which in some places are arranged in rows and groups. The substance between these tubes is transparent, and contains no corpuscles. The articular cartilage above described is gradually being converted into bone during the whole of life." (p. 165-7.)

The nutrient vessels of articular cartilage during its development, which are situated betwixt it and its synovial membrane, "are contained and ramify in a considerable layer of cellular tissue," by which that membrane is attached to the articular cartilage, and from which Toynbee detached nearly the whole. His statement, however, that "these vessels have been alluded to by Dr. William Hunter under the name of 'circulus articuli vasculosus,'" is quite incorrect, as reference to the passage already quoted will prove; in which Hunter says, they "plunge in by a great number of small holes, and disperse themselves into branches *between* the cartilage and the bone;" and not "*on* the entire surface of the articular cartilage," as described by Toynbee. "It is difficult," says this latter writer, "to state generally at what period of fœtal existence these vessels, which have been spoken of in the first stage as forming convolutions around the joints, are prolonged upon its (the articular cartilage's) surface." But, after having studied with care these stages, he states, that "at between the *third* and *fourth* month of fœtal life these vessels are simply a mass of delicate convolutions, situated between the synovial membrane; at the *fifth* month, these convolutions are somewhat unravelled, so as to extend over the surface of the cartilage to the distance of about half a line; and at between the *seventh* and *eighth* months, they are drawn out and prolonged to the distance of a line and a half. At this stage, these vessels consist of arteries of considerable size, which radiate in a straight course from the attachment of the *ligamentum teres*. They give off but few branches, and, previous to terminating, divide and sub-divide, but do not much diminish in size. They terminate by turning and forming loops with the small veins. Subsequent to the *eighth* month these vessels begin to recede in their course; and at *birth*, and the periods subsequent to it, they are again found to be gathered immediately around the point of attachment of the *ligamentum teres*. After these vessels have receded, the position they occupied at the more early periods may be for some time detected by the white aspect of the cellular tissue between the cartilage and the synovial membrane." In the knee-joint there is a little difference: "The arteries which have run straight towards the centre of circulation, give off small branches, forming a delicate net-work communicating with the small veins, and terminate either by turning in their course, and forming broad loops with the venous radicles, or empty themselves into a single vessel from which the veins arise." (p. 168.)

The canals in adult cartilage, already mentioned, Toynbee describes as "irregular in their distribution; some are merely dilated cavities; frequently several of these cavities are elongated and arranged serially, running from the attached towards the free surfaces of the cartilage. At the free or synovial surface these canals do not exist; the cells of the texture at this part being elongated and flattened, and having their long diameters parallel to the free surface. These canals contain a transparent fluid, which is seen to ooze from them after a section. It is most probable that the uninjected vessels mentioned by Meckel, Bichat, and others, were these canals and sinuses." (pp. 169-70.) The observations just alluded to are the following:—Meckel (a) says,

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(a) Handbuch der Menschlichen Anatomie, vol. i. Halæ et Berol., 1815-20.

"Cartilages do not receive vessels carrying red blood, although in cutting them distinct vessels are frequently observed in their substance." **Bichat** (*a*) observes that in cartilage "no blood-vessels are distinguishable. The exhalant system carries only white juices; but as this system is continued to the arteries of the neighbouring parts, so that the organic sensibility is there elevated by weak irritants, and so brought into relation with the red globules of the blood, that they pass readily, whence arises the redness which cartilage assumes, as seen in inflammation, wounds, &c. It is exactly the same as occurs in inflamed conjunctiva, &c. When the irritation ceases, the sensibility resumes its natural type, and the red globules at the same time become alien to the cartilage, which recovers its whiteness. We know not the nature of the white fluids ordinarily circulating in the vascular system of cartilage. They are very susceptible of becoming the vehicle of the bile, or, at least, of its colouring substance, when diffused throughout the animal economy in jaundice." (p. 129-30.) **Müller** (*b*) states, that "in tendons, ligaments, and cartilage, there are blood-vessels, but few in number." (p. 362.)

In **Brodie**'s opinion the cartilages are vascular. He says:—"Up to the period of growth being concluded, we must suppose the articular cartilages to be vascular, otherwise we cannot account for the changes of bulk and figure which mark their progress towards complete development. In the child, canals or sinuses may be seen ramifying through their substance, containing blood, and manifestly intended to answer the purposes, though not constructed with the distinct tunics of ordinary blood-vessels. In the adult person these canals for the distribution of blood are not perceptible. This proves that they are very minute, but not that they are altogether wanting." (p. 111.) He also supports his opinion by the analogy of "the transparent cornea of the eye, in which no vascular structure can be detected under ordinary circumstances, but the existence of vessels in it is proved by the changes which it undergoes in disease; and when it is inflamed such vessels become distinctly visible, injected with red blood. So we meet with occasional though rare instances of vessels containing red blood extending from a diseased bone into the cartilage covering it." Also by the exposure of the joint cartilages to friction without being affected by it, which "cannot be explained unless we admit the cartilages to possess a power of reparation; and this must be supposed to depend, as in other textures, on the action of blood-vessels modified by that of the absorbents." And lastly, he brings forward the occasional conversion of an articular cartilage "into a number of ligamentous fibres, each of which is connected by one extremity to the bone, whilst the other is loose towards the cavity of the joint. Here is a morbid alteration of structure, the occurrence of which seems to indicate that there must be such a vascular apparatus entering into the formation of cartilage as enables new materials to be deposited and old materials to be absorbed, and without which morbid alterations of structure do not take place in other parts of the body." (p. 111-13.)

Toynbee, however, asserts, that "into the substance of healthy cartilage he has never been able to trace blood-vessels, and his researches induce him to believe that they do not possess any. (p. 170.) Of the same opinion, also, is **Beclard** (*c*), who says:—"These cartilages have no vessels; delicate injections and microscopic examinations exhibit the capillary vessels terminating at the circumference and adhering surface without ever penetrating their substance." (p. 466.) And **Cruvelhier** (*d*) still more decidedly affirms, that "the diarthrodial cartilages do not present any trace of organization." (p. 162.)

The importance of the subject will, I trust, be sufficient apology in regard to this long anatomical digression, in which it will be observed that **William Hunter** appears to have held generally very correct views on the structure of cartilage, excepting as to its fibrous character. The reader will also be struck with the near resemblance of the opinions held by **Toynbee** and **Henle**. I have, indeed, mentioned those of the latter author first, as in the course of the narrative it was convenient so to do. But the statements of both were published in the same year, and it is scarcely possible that either could have had knowledge of the views of the other.—J. F. S.]

At first, the patient feels only little and passing pain, which is increased by the motions of the joint, but ceases when it is at rest. It gradually becomes continuous, and spreads from the joint over the bones. After several weeks or months, the swelling of the joint is affected with a slight external inflammation. This swelling is neither great nor fluctuating, and has pretty much the form of the joint. After a shorter or longer time,

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(*a*) Anatomie Générale, vol. iii. Edit. 1812.

(*b*) Handbuch der Physiologie, vol. i. Coblentz, 1834.

(*c*) Anatomie Générale.

(*d*) Observations sur les Cartilages Diarthrodiaux; in Archives Générales de Médecine, vol. iv.

suppuration in the joint occurs: it breaks, and hectic fever destroys the patient. Although the course of this disease is nearly always insidious in its beginning, peculiar conditions may increase the symptoms, and the disease assume an acute form.

Mayo (*a*) speaks of "three distinct forms of ulceration" of joint-cartilages, which, although they may be occasionally combined, are oftener met with separately. (p. 49.) *First.* Rapid absorption of cartilage beginning on its synovial aspect; the new surface, if cartilaginous, being smooth and unaltered in structure; if of bone, healthy; the absorption of cartilage being attended with inflammation of the capsular synovial membrane. (p. 50.) This form is "of rare occurrence. The absorption of cartilage takes place rapidly. It is attended with severe pain, with inflammation of the capsular synovial ligament, and generally with suppuration in the cellular tissue adjacent to the joint. The only favourable termination of the disease, that I have witnessed, is anchylosis. *Second.* Chronic ulceration of cartilage beginning on its synovial aspect, producing an irregularly excavated surface with fibrous or brush-like projections of the cartilage and synovial membrane, attended with inflammation of the capsular synovial membrane, and sometimes of the same membrane where it is reflected over the cartilage, the bone and the surface of cartilage towards it being healthy. (p. 53.) *Third.* Absorption of cartilage beginning on the surface towards the bone, attended with inflammation of the adjacent surface of the bone, with inflammation of the synovial membrane, and sometimes with sensible vascularity of the cartilage itself." (p. 59.)

[As to the inflammation of cartilage, if such there be, **Wilson** (*b*) observes, "the active powers of life are possessed by articular cartilages in a very limited degree, so much so, that the ocular demonstration is wanting of their being *capable* of inflammation. This affection is in other parts marked by a state of vessels easily distinguished by the eye and by the touch; but, as vessels are not to be seen or felt in these cartilages, we have not sufficiently decisive proofs of inflammation ever taking place in them. I have never seen in articular cartilages, which were completely formed, any vessels either filled with its own blood or having its cavity distended by injection." (pp. 327, 28.)

John Hunter (*c*) takes no notice of this point at all; but, after speaking of the union of fractured cartilage by bone, proceeds:—"Sometimes the inflammation goes on to suppuration; but they (the cartilages) seem to have insufficient power to admit of ulceration, yet they may be absorbed by the absorbents of other parts, as in white swellings, when suppurated, the cartilaginous ends are removed by the absorbents on the surface of the ends of the bone that the cartilage covers. It may be ulcerated in this manner in other joints also: in the knee we find all the different stages of absorption of cartilage; granulations will shoot from under the cartilage, and sometimes, when there is not much matter in the joint, these granulations will inosculate and form a bony union. (p. 535.)

Wilson says that "the synovial membrane which lines the capsular ligament, and is reflected from it over part of the bone to the edge of the articular cartilage, will indeed sometimes pass a little way on the surface; it there becomes inseparably connected with the cartilage, and its appearance is then lost." But he continues:—"In a diseased state of joint, I certainly have seen the surfaces of the articular cartilages covered by a membrane, but this membrane I have no reason to believe to have been originally more than a coating of coagulable lymph; it is of different degrees of thickness, and at first easily peels from the surface it covers, but it soon becomes organized and very vascular. In a preparation, belonging to the Windmill-street museum, vessels seem to pass from this new formed membrane into little inequalities on the surface of the cartilage, and it is far from improbable but that absorbent vessels may be among these, and which are employed, along with the absorbents from the bone, in removing the articular cartilage. * * * I do not mean to deny the possibility of the removal being attempted partially by vessels belonging to their own substance, so as to produce some of the appearances called ulceration of cartilages; but we are deficient in proofs of this, and, from what I have observed of the state and appearance of diseased joints, I am induced to abide by the opinion entertained by **John Hunter**, that the removal of articular cartilages is generally effected by the vessels of the neighbouring more vascular parts, viz., of the bones and synovial ligaments, and occasionally by the vessels of coagulated and organized lymph." (pp. 328, 29.)

(*a*) On Ulceration of the Cartilages of Joints; in Med.-Chir. Trans., vol. xix.

(*b*) Lectures on the Structure and Physiology of the parts composing the Skeleton, and on the Diseases of the Bones and Joints, &c. Lond., 1820. 8vo.

(*c*) Lectures; **Palmer**'s Edition.

Brodie, however, holds there is "sufficient to prove that the articular cartilages may be absorbed or ulcerated from the action of their own vessels, and that the ulceration may begin, and frequently does begin, on that surface which is towards the articular cavity. At the same time it is to be observed that in many instances the ulceration begins in another situation, and I have frequently seen the cartilage abraded where it had been in contact with the bone, while on the surface, towards the cavity of the joint, it remained smooth and perfect. Under these circumstances the space formed by the absorption of the cartilage becomes filled up by a vascular substance resembling granulations, and uniting the bone and cartilage to each other. In whatever way the ulceration of the articular cartilages is produced there is this remarkable difference between it and the ulceration of soft parts: suppuration seldom takes place while the ulcer of the cartilage is small, and often the disease proceeds so far as to cause caries of the bones to a great extent without matter being formed in the joint. This circumstance is deserving of notice. It has long been established, that suppuration may take place without ulceration, and it appears that, in this instance, ulceration occurs without the formation of pus." (pp. 116, 17.)

Lawrence (*a*) also says, that "ulceration of cartilage" not only takes place from other causes, but "as an original affection of the joints. Without any disease of the synovial membrane, without the occurrence of any accident or injury, it may commence as a primary or original affection of the joint itself. The ulceration is attended with two circumstances which are very different from those we observe in ulceration of other structures. There is no formation of pus, nor do we ever find granulations produced from diseased cartilages—no attempt at reproduction of the cartilaginous structure. Although ulceration of the cartilages may be in the first instance limited to the cartilaginous structure itself, yet it soon involves other parts of the joint. It extends in the first place to the bony articular extremities, which become ulcerated, and are, in common language, rendered *carious:* the synovial membrane and external soft parts about the joint become inflamed: small abscesses form and break externally; a succession of these takes place in various parts of the joint, and a number of fistulous openings are established about the joint, giving place to matter, and, in many cases, to carious portions of bone. The ulcerative process often extends to the ligaments that connect the articulations; the consequence of which is, that the bones are no longer retained in their relative positions, but are thrown into certain unnatural directions by the action of the strong muscles of the limb." (p. 483.)

According to Key's views, the ulceration of cartilages, commonly so called, depends on four conditions, in three of which "the cartilage," he says (*b*), "is not absorbed *per se*, but through the agency of a structure, probably evolved for the special purpose of completing that process," and the fourth is "the result of disorganization of texture." The first two forms, viz., "the loss of articular cartilage that attends upon the chronic inflammation of the synovial membrane, and the more active destruction of the articular cartilage that attends acute inflammation of the joint," appear to me simply modifications of the same process by the degree of the inflammatory action, and, therefore, to be considered as one form, either in its chronic or acute stage, as may be, the result of which is the production of a vascular and absorbing membrane from the synovial membrane. The next is "the absorption of cartilage that accompanies strumous disease of the cancellated structure of bone," or that condition mentioned by Brodie, in which "the cancellous structure of the bones is the part primarily affected; in consequence of which ulceration takes place in the cartilages covering their articulating surfaces." (p. 226.) The consideration of this form must be deferred to Inflammation of the Joint-ends of Bones. (*par.* 221–24.) The last condition, much less frequent, is that in which Key says, "that structure (cartilage) appears to undergo a change in its organization, independent of foreign agency. * * * An action altogether different from absorption, and analagous to the softening of the intervertebral substance." To which he applies the term "disintegration, in contradistinction to absorption, the one being a loss of substance from an absorbing action, the other being the result of a disorganization of texture. It is the primary ulceration of cartilage described by authors." (pp. 134, 35.)

Of the absorption of cartilage by a new membrane produced by inflammation of the synovial membrane,

Key (*c*) thus speaks:—"In a manner analogous, in many respects, to the process of removing dead bone, does nature achieve the task of absorbing the cartilaginous structure covering the articular extremities of bones. These structures possess but

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(*a*) Lectures in Lancet.

(*b*) Further Remarks on the Ulcerative Process; in Med.-Chir. Trans., vol. xix.

(*c*) On the Ulcerative Process in Joints; in Med.-Chir. Trans., vol. xviii.

a low degree of organization; in their healthy condition they present very few of the characters of animal vitality: they exhibit scarcely any trace of red blood vessels, and, for obvious reasons, their supply of nervous influence is not more than sufficient to connect them with the surrounding structures, as part of a whole. Under disease they exhibit that want of action which might be anticipated from the limited extent of their organization. In acute inflammation of a joint, while the synovial membrane and ligaments are much altered, the cartilage appears unchanged in colour or in texture, and apparently uninfluenced by the increased action going on in the surrounding parts. The cartilage becomes, under disease, softer somewhat in texture; but this change may be as well attributed to the absence of pressure as to the effect of inflammatory action; for healthy joints when kept long at rest are found to undergo a similar change, on their cartilaginous surface, from the want of that pressure to which they have been accustomed, and which may be necessary to the preservation of their due consistence. There are, however, some forms of inflammation under which the cartilage, very early in the disease, undergoes a change of structure: these instances are much less frequent, and may be looked on as exceptions to the ordinary rule." (pp. 216, 17.)

"The progress of ulceration in cartilage covering the ends of bone," continues KEY, "is not uniform in its course. The means by which it is effected vary according to the cause that gives rise to it. It is sometimes the result of acute synovial inflammation, or of a chronic affection of that membrane: it is occasionally found as a primary affection, independent of the other textures of the joint. * * * I am inclined to believe that inflammation of this membrane is the most frequent cause of ulceration of the cartilage. This opinion I have been led to adopt from the examination of a considerable number of diseased joints, in which ulceration of cartilage has been found to exist in different degrees of progress from its most advanced stage, in which the bone has been entirely denuded, to the very incipient abrasion of its surface or margin. The history of some of these cases, together with the morbid appearances, has also satisfactorily proved the existence of a long-continued synovial affection, before any alteration of the cartilaginous surface could have taken place, as the cartilage in some has been quite sound, with the exception of a slight loss of substance at the edge of the bone, where the synovial membrane is reflected from it: while the symptoms of diseased joint have existed for many months, with pain over a large part of the synovial surface, and general swelling of the joint. * * * The inflammation of the synovial membrane that leads to ulceration of cartilage in the ordinary strumous affection of joints in the adult, is not, as far as my observation goes, of the most acute kind. * * * The less acute forms of the disease, assuming various shades of activity between the chronic and the acute forms, rarely occur for any great length of time without the cartilage participating in the mischief. This may in some measure depend on the peculiarity of those constitutions in which sub-acute inflammation seems to have a spontaneous origin. The knee-joint is most frequently observed to suffer disorganization from this form of inflammation. * * * When the more acute symptoms are subdued (by treatment) the membrane sometimes fails to regain its normal condition, passing into a chronic form of action so slight as to attract but little attention, and often regarded as stiffness that will yield to exercise and passive motion. This slight degree of inflammation that remains often lays the foundation of future mischief, especially if the condition of the patient's health is not adverted to after the acute stage of the inflammation has subsided. The nature of the remedies employed always leaves the patient in a state of weakness and irritability, under which the low degree of action that remains in the joint will be disposed to assume the ulcerative form. * * * This state of joint as the disease advances is usually attended with more pain, than when the disease assumes from the commencement the chronic form; the intervals of ease become short and few; and the action goes on with but little interruption to the formation of abscess. In the chronic form of synovial inflammation that occurs in indolent habits of a strumous tendency, especially in persons below the age of puberty, years often elapse before the ulcerative process is completed. The symptoms are proportionally mild in their course. The joint is not much swelled, the general and uniform fulness of the joint, so characteristic, as BRODIE has observed of the most acute forms of inflammation of the synovial membrane, is absent; the joint appears as if the bones themselves were enlarged, an appearance as much produced by the shrinking of the limb above and below the joint as by the swelling of the joint itself. The swelling of the soft parts about the joint depends on the degree of inflammation present in the synovial membrane, and the consequent effusion in the soft parts. In the most chronic forms the bones can almost be felt through their ligamentous investments; in the less chronic forms, when the disease runs its course in a shorter period, there is effusion of albumen in the soft structures surrounding the joint, which increases its volume, preventing the bones being distinctly felt, and in some measure altering the form of the joint. (pp. 218-22.)

"The patella and the extremity of the femur are the parts on which the ulcerative process can be best traced, on account of the disease being in these less advanced. In the former bone, the first part that commonly gives way to ulceration is the margin of the cartilage, where the synovial membrane is reflected from it. At this point sulci of different depths are formed, which cannot be always distinguished until the thickened edge of the synovial membrane is raised. The ulcerated surface sometimes exhibits parallel vascular lines, verging towards the centre, and having their origin from the synovial membrane. The synovial membrane at this part, if the vessels are well filled with fine injection, appears highly vascular and fringed, or villous, like a mucous membrane. This increased vascularity is particularly noticeable at the edge of the membrane and in those portions of the fringed margin that correspond to the ulcerated surface of the cartilage; the other parts of the synovial membrane have their vascularity but slightly increased. This highly vascular fringe of membrane is a newly organised, and will be found in some parts to be a superadded, structure, for the purpose of producing ulceration of the contiguous cartilage. It may, when recently formed, be raised in some parts from the synovial membrane, but is found to adhere very slightly to that part of the cartilage where ulceration is going on; this adhesion is not perceived unless the joint is opened with great care. * * * The process, therefore, by which the ulceration of cartilage is in this case effected, is analogous to that by which the sequestrum of the cylindrical bones under necrosis takes place. Indisposed to ulceration, from the low degree of its organization, it is acted upon by the newly organised synovial surface, which is rendered highly vascular, and by means of its villous processes forms a groove in the edge of the cartilage, thus commencing the work of destruction. The cartilage at the edge is sometimes entirely destroyed, so as to lay bare the bone, in which case vascular granulations also arise from the surface of the exposed bone, and assist the membrane in the work of absorption. This, however, is more usually observed in the most acute form of inflammation. In the more chronic form, the vascular fringe of synovial membrane contracts adhesion to the surface of the cartilage in which ulceration is going on, and gives rise to the formation of a new membrane, which spreads gradually over the surface of the cartilage. A diseased joint is hardly ever examined without exhibiting one or more of the bones partly covered with this pulpy membrane. When injected, its vascularity is found to vary according to the activity of the inflammation in the joint; when first formed it exhibits considerable vascularity during the ulcerative process: when the cartilage has been wholly absorbed, and the ulcerative process has been checked by the inflammation being arrested, this membrane then serves another purpose; it becomes the medium of union between opposed surfaces of bone, or the means of anchylosis. Long after all inflammation has subsided, one of the condyles of the femur is often found adhering to the tibia by means of this membrane, which appears white and ligamentous; a layer of cartilage often remaining between the membrane and the bones, as if the process of ulceration were arrested." (p. 223-226.)

Goodsir (*a*) holds with Key in the deposit from the synovial membrane being the cause of ulceration in cartilage; for, as "in the thin articular cartilages of the adult human subject, few or no vessels can be detected, it is evident that in the process of ulceration in cartilage, it cannot be the usual blood-vessels of the part which are the active agents, still less likely is it that lymphatics, the existence of which has never been asserted in this texture, are the absorbing instruments." He then proceeds:—"If a thin section, at right angles, be made through the articular cartilages of a joint, at any part where it is covered by gelatinous membrane in scrofulous disease, or by false membrane in simple inflammatory condition of the joint, and if this section be examined, it will be found to present the following appearances. On one edge of the section is the cartilage unaltered, with its corpuscles natural in position and size. On the opposite edge, is the gelatinous, or false membrane, both consisting essentially of nucleated particles, intermixed, especially in the latter, with fibres and blood-vessels; and, in the former, with tubercular granular matter. In the immediate vicinity, and on both sides of the irregular edges of the section of cartilage, where it is connected on the membrane, certain remarkable appearances are seen. These consist, on the side of the cartilage, of a change in the shape and size of the cartilage corpuscles. Instead of being of their usual form, they are larger, rounded, or uniform; and, instead of two or three nucleated cells in their interior, contain a mass of them. At the very edge of the ulcerated cartilage, the

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(*a*) **The Process of Ulceration in Articular Cartilages; in his Anatomical and Pathological Observations. Edinburgh, 1845. 8vo.**

cellular contents of the enlarged cartilage corpuscles communicate with the diseased membrane by openings more or less extended Some of the ovoidal masses in the enlarged corpuscles may be seen half released from their cavities by the removal of the cartilage; and others of them may be observed on the substance of the false membrane, close to the cartilage, where they have been left by the entire removal of the cartilage which originally surrounded them. If a portion of the false membrane be gradually torn off the cartilage, the latter will appear rough and honeycombed. Into each depression on its surface a nipple-like projection of the false membrane penetrates. The cavities of the enlarged corpuscles of the cartilage open on the ulcerated surface by orifices of a size proportional to the extent of absorption of the walls of the corpuscle, and of the free surface of the cartilage. The texture of the cartilage does not exhibit, during the progress of the ulceration, any trace of vascularity. The false membrane is vascular, and loops of capillary vessels dip into the substance of the nipple-like projections which fill the depressions on the ulcerated surface of the cartilage; but, with the exception of the enlargement of the corpuscles, and the peculiar development of their contents, no change has occurred in it. A layer of nucleated particles always exists between the loops of capillaries and the ulcerated surface. The cartilage, where it is not covered by the false membrane, is unchanged in structure. The membrane generally adheres with some firmness to the ulcerating surface; in other instances it is loosely applied to it; but, in all, the latter is accurately moulded to the former. (p. 17–19.)

The view given by KEY, of the usual mode in which cartilage is absorbed, or as it is commonly called, ulcerates, is in the main similar to that held by WILSON, but more fully and more satisfactorily developed. Its correctness I cannot doubt, for I have seen it, I think more than once or twice, from the first commencement, in which, on carefully lifting up the new membrane, its perfect impress is perceived upon the cartilage, varying in depth and extent according to the thickness and size of the membrane, till the entire depth of the cartilage is removed and the membrane comes in contact with the bone, the articular surface of which is also destroyed either by it or by simultaneous inflammatory action set up in the cancellated structure of the bone. The preparations to which I allude are in St. Thomas's museum, and some of the patients were under my own care.—J. F. S.

"When *suppuration*," KEY continues, "*follows acute inflammation, from a wound of the synovial membrane*, the latter undergoes that change which enables it to perform its new function. The surface becomes highly vascular, and, in most parts, covered with a new deposit of adhesive matter, which adheres firmly to the synovial membrane. The new surface is irregular, wanting the polish of the original membrane, and appears in many parts villous, or furnished with vascular fringed projections. In a joint thus far advanced in disease, the only mode of arresting the disease, or of repairing the mischief occasioned by the inflammation, consists in anchylosis. To this end, the removal of the cartilage is an essential step; and it would appear that the office of removing it devolves on the inflamed synovial membrane. The cartilage, under these circumstances, is not only eroded at the edge where the synovial membrane is reflected upon it, but grooves and indentations may be traced in various parts of it, having no connexion, as in the progressive strumous form of ulceration, with the edge of the synovial membrane, and not showing any indications of a new membrane forming on its surface. The means by which this ulceration is effected appear to be the newly organized surface of the synovial membrane in contact with the parts in which absorption is going on. To those who will carefully examine joints in this condition, the evidence of this will, I think, be sufficiently conclusive. The absence of all action in the cartilage, and the total want of vascularity in those parts, where ulceration appears to be most active, were the circumstances that first led me to look for some agent in the work of ulceration. The ulceration evidently begins on the surface of the cartilage, and not on that side next to the bone. It presents merely an eroded surface; there is no disorganization of its texture in the parts where absorption is about to take place; there is no previous degeneration of the cartilage into its primary fibrous structure, as may be seen in other forms of ulceration; but the cartilage seems to have lost part of its surface, as if it had been dug out, the remaining part appearing healthy, and presenting no trace of increased vascularity. The grooves are found only in those parts of the cartilage that happen to be opposed to the fringed and vascular synovial membrane; and these highly organized portions of the membrane may be seen to be closely adapted, and even to fit into the grooves in the cartilage. Those parts of the cartilage that happen to be in contact with another cartilaginous surface present no signs nor trace of ulceration, but appear to the eye perfectly healthy, and in texture firm. The process exhibits the closest analogy to that by which nature removes dead bones; the same inactivity or passive condition of the parts absorbed; the same suppurative action from the vascular granulation; and a similar degree of vascularity bestowed upon the newly organised structure which has to perform the office of absorption. It is not, however, in every instance of suppuration in a joint, even where this villous membrane is found, that ulceration of the opposite cartilage is to be looked for as an uniform occurrence; for strumous joints are occasionally examined, in which the synovial capsule has been for many months distended with purulent secretion, and the synovial membrane covered with flocculi hanging into the joint, without a trace of ulceration in the opposite cartilaginous surface. This exception rather favours the view which I have advanced of the ulcerative process in the case of suppuration from wound. The condition essential to the act of absorption is here wanting. There is not a wound or opening by which the pus can escape as fast as it is secreted: it consequently collects in the cavity of the joint, and, by distension, prevents the membrane coming in contact with the cartilage; and the villous projections from the membrane, even when the vessels are well filled with fine injection, do not exhibit that degree of vascularity which is so clearly developed when ulceration of the cartilage takes place. (p. 234–37.) Nature, it seems, does not often adopt this mode of removing the cartilage. It is only in the acute form of inflammation, as in wounds of joints, that I have observed it. The process of removing the cartilage appears at all times, and under all circumstances of disease, an object that she endeavours to accomplish; while the cartilage remains entire, anchylosis, the natural cure in some forms of diseased joint, cannot be effected; and, therefore, we may often observe ulceration of cartilage going on very early in those diseases that, forming some defect in the patient's constitution, cannot be arrested without anchylosis. (pp. 239, 40.)

Brodie (*a*), however, still considers that "the explanation which **Key** has offered does not admit of a general application, and that the absorption of the cartilage, commencing on the surface towards the cavity of a joint, may take place under such circumstances, that it cannot be supposed to be the result of any other agency than that of the vessels of the cartilage itself. (p. 331.) In speaking of ulceration of the articular cartilages, as a conseqnence of inflammation of the synovial membrane, I have not endeavoured to explain the exact nature of the process by which such ulceration is effected, and simply for this reason,—that I have not been able completely to satisfy my own mind on the subject. There can be no doubt that, in many instances, ulceration begins at the margin of the cartilage, where the synovial membrane is reflected over it from the neighbouring bone, or from the inter-articular ligaments, where such ligaments exist; but it may still admit of a question, in what manner the ulceration is accomplished; whether it be from the inflammation extending directly to the cartilage itself, or to the bone first, and the cartilage afterwards; or whether, according to the views entertained by Mr. **Key**, the latter, being altogether in a passive state, becomes absorbed by the action of the vessels of the fringed processes of the synovial membrane lying in contact with it. But there are other cases of inflammation of the synovial membrane, in which ulceration begins in the centre of the cartilage, so that none of these hypotheses afford any reasonable explanation of it. It seems not improbable that, in some of those cases which are usually regarded as examples of simple inflammation of the synovial membrane, the inflammation may not have been confined (even in the first instance) to this individual part, but may have begun simultaneously in all the textures of the joint. This is in conformity with what is observed to happen occasionally in the eye and other organs; and, under such circumstances, it is no more than might be expected, that, as the inflammation subsides, the cartilage should ulcerate either in the centre or in some other part of its surface. Nor is this a merely speculative opinion; at least I am much mistaken if it be viewed in that light by any one who, after having perused the history of the following case, considers what would probably have happened if the patient had not died of another disease before there was time for the disease in the joint to have run its course. A gentleman, about twenty-five years of age, had laboured for several years under a disease of the brain, in consequence of which he had been in a state of complete helplessness and imbecility. In the summer of 1820 he became indisposed otherwise: there was a cluster of enlarged glands in the left groin, and a purulent sediment was deposited by the urine. I was now desired to see him in consultation with Dr. **Maton**, who was his ordinary medical attendant. Soon afterwards, it was observed, that there was a general tumefaction of the left thigh and nates, and the patient complained of pain in certain motions of the limb. Under the treatment employed, the tumefaction subsided; but, immediately afterwards, a violent attack of diarrhœa took place, under which he sunk, and died on the 29th July. On examin-

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(*a*) Additional Notes on Ulceration of Cartilage; in the Third Edition of his book on the Diseases of Joints, 1834.

ing the body we discovered an abscess, which seemed to have had its origin in the cellular membrane of the pelvis, near the neck of the bladder, which had burst into the neighbouring portion of the urethra, and which had also extended upwards on the left side, so that it could be traced as high as the mass of enlarged glands in the groin. The whole of the muscles surrounding the left hip-joint, were preternaturally soft and vascular, and so altered from their natural condition, that they could be lacerated by the slightest force. They also were to a considerable extent detached, or separated from each other, apparently in consequence of a serous fluid which had been effused between them, but of which nearly the whole had become absorbed. The capsular ligament and synovial membrane of the joint were of a red colour, and unusually vascular; and the cartilages covering the head of the femur and lining the acetabulum were also red and of a soft consistence, giving to the fingers a sensation somewhat resembling that which is produced by touching velvet." (p. 336–39.)

A very remarkable instance of ulceration of cartilage in an almost incredibly short space of time is mentioned by LAWRENCE (*a*). In a case of phlebitis, after bleeding, which came under his own care in St. Bartholomew's Hospital, the patient had pain in his knee, commencing on the fourth, and he died on the eighth day of the same month. "On examination after death I found the knee-joint filled with pus of a reddish colour, that is, with pus rendered red by the admixture of blood. The synovial membrane which had produced this pus was highly inflamed, but the articular cartilage of the femur and the corresponding articular surface of the tibia were completely destroyed, and this high degree of ulceration had been produced within the short period mentioned." (pp. 482, 3.)

He also mentions the following very curious circumstance:—"When necrosis attacks the shaft of a long bone, though it does not involve the ends, yet the mortification extends (or rather may extend ?—J. F. S.) sufficiently to the extremities to excite inflammation and absorption of the cartilages, although the synovial membrane does not become involved." And he speaks of a case in which "the whole shaft of the thigh-bone had perished, and the cartilages were as completely removed as if they had been cut out by the knife." (p. 483.) This appears to me the condition, though much more advanced, to which KEY refers, when, having spoken of the vascular deposit on the synovial membrane that destroys cartilage, he proceeds:—"A membrane is sometimes seen in joints under different circumstances, and affords a contrast to the above, as well in structure as in office. I allude to that adventitious membrane that is formed from the edges of the synovial membrane, in consequence of inflammation of a joint, induced by a contiguous disease of bone, as necrosis. In this case the membrane is formed for the purpose of circumscribing the cavity of the joint, when the cartilage is destroyed by the extension of the disease. It possesses but little vascularity, is smooth on its surface, not being furnished with the villous texture necessary to the ulcerative function. The opposed cartilage, under these circumstances, appears entire, ulceration taking place only on the surface next to the bone, and the membrane has not any connexion with the surface of the cartilage." (pp. 226, 27.)

Although it appears that, under inflammation, either chronic or acute, the less or greater deposit of coagulable lymph from the synovial membrane, which becomes organized, absorbs or eats up the cartilage with which it is in contact, as has been so ably described by KEY just quoted, and often requires amputation of the limb to tranquillize the constitutional excitement of the patient, which, if continued, would wear out his powers and destroy him; yet is it not to be considered as always a destructive, but rather, as KEY (*b*) has very truly stated it to be, "a repairing process, established with a view to the ultimate anchylosis of the joint, and by an efficient provision to prevent an inflammatory process that would otherwise end in ulceration and suppuration. A membrane is gradually developed by the agency of which the cartilage is absorbed, and which afterwards becomes the medium of anchylosis; thus the destruction of the joint is often prevented." (p. 146.)

HENLE agrees with KEY as to the absence of vessels in cartilage, but he explains its wasting or ulceration as dependent on want of nutriment. The following are his observations on the subject:—"As cartilage has not vessels it is not subject to any disease which depends on unnatural movement of the blood, neither inflammation nor hypertrophy; for the same reason, as it needs no vessels, it is not so easily wasted by pressure as bone * * * Cartilage only wastes when the current of blood into the tissue upon which its nutrition depends is interrupted; the diseased cartilage, as for instance of inflamed joints, therefore is destroyed as if by maceration, rough, then as it were eaten, and finally dissolved." (p. 809.)

(*a*) Lectures on Surgery; in Lancet, 1829-30, vol. ii.

(*b*) Med.-Chir. Trans., vol. xix.

Of Ulceration of Cartilage.—This, the more rare mode in which destruction of cartilage is effected, really occurs in the cartilage itself, and is described by Key (*a*) as "an action altogether different from absorption, and analogous to the softening of the intervertebral substance," in other words, "the result of disorganization of texture." (p. 135.) But before stating his opinions on this subject it will be advisable to mention his views on ulcerations in general, for the better comprehension of their application to cartilage. "Ulceration is a process analagous to the softening attending suppuration; it is a degeneration of tissue, a change in the affinities existing between its component parts, by which it becomes changed from a solid texture to a fluid inorganic mass. It differs from gangrene in being a vital action; while gangrene, by at once producing death in a part, prevents any such change taking place. In gangrene the supply of blood to the part altogether ceases, while the integrity of tissue is preserved; under ulceration the circulation in the vessels continues during the action, and the part still belongs to the living mass, and remains under the influence of vital action until its separation is completed." (pp. 137, 38.)

"Ulceration of cartilage," says Key, "is effected in the same manner as an ulcer in soft parts; it is a destructive action that sooner or later is followed by suppuration of the joint. It commences in the structure of the cartilage itself, which, no longer under the influence of those forces that unite its integral parts, breaks up, and becomes converted into a purulent mass, which, mixing with the synovia of the joint, irritates the synovial membrane to inflammation, and ultimately to suppuration and ulceration. Ulceration of cartilage, however, as a primary disease, is a much less frequent occurrence than absorption through the intervention of membrane. I do not remember," says Key, "to have examined a joint, that had been the subject of ordinary chronic inflammation, in which this membrane was not more or less developed. Nor have I seen an instance of chronic inflammation, in the early stage of strumous disease, in which degeneration or ulceration of the cartilage existed as the primary action. Chronic inflammation, however, after existing for many months or years in strumous subjects, may, and often does, become acute, and ulceration sometimes, in such cases, supersedes the absorbing process, and abscess rapidly forms. * * * Nature endeavours, so long as she can, to remove the cartilage by absorption, in order to prevent the necessity of suppuration; for primary ulceration of cartilage leads to the formation of abscess. The breaking up of the tissue of the cartilage is equivalent to the suppurative process in softer tissues; it creates a product that must be got rid of; the synovial membrane is irritated, and ulceration with abscess is the result. In absorption of the cartilage through the intervention of the membrane, suppuration is not a necessary attendant, and we sometimes find the whole process completed without abscess. But where the membrane is wanting, the process is analogous to the degeneration of soft parts, and is sooner or later followed by suppuration. * * * The diseases in which the texture of the cartilage primarily undergoes ulceration are, for the most part, acute from their commencement. The inflammation that follows wounds of joints often leads to the rapid ulceration of the cartilage, and to burrowing abscess. In these cases, the cartilage is found often to be extensively destroyed, and the bone laid bare, without any appearance of a membrane for the purpose of absorption. The remaining cartilage sometimes exhibits different stages of approaching disorganization; in some parts retaining its natural form, consistence, and appearance; in others being soft and spongy, or even pulpy; and in those parts most advanced towards ulceration, the fibre of the cartilage can be seen to separate, and flakes here and there appeared to be almost detached. * * * The chronic inflammation of the synovial membrane, attended with absorption of the cartilage, not unfrequently becomes acute from accidental causes, and, leading to ulceration, quickly disorganises the joint. Both ulceration and absorption may here be seen to operate. In some parts may be seen the membrane adhering to the cartilage or to the denuded bone, in various degrees of activity or vascularity, according as its office is completed or in progress; and in others a total loss of the cartilage may be observed, without the development of a membrane. It is not unusual for one half of a knee-joint to be losing its cartilage by absorption, while, by a process of inflammation subsequently excited, the other is in a state of active ulceration. On one side the cartilage is furnished with the absorbing membrane, which sometimes spreads over the whole of that side of the cavity, and protects it from the devastating process of ulceration that is at work on the other side of the joint, which is filled with pus and the remains of the disorganised cartilage. In persons who have become extremely irritable and weak, the ulcerative process is so determined, that the membrane itself is sometimes found in a state of ulceration." (p. 146–50.)]

(*a*) Med.-Chir. Trans., vol xix.

217. On examination of the joint after death, produced by other diseases, it has been found, if the disease were still in its commencement, that the cartilage, at one or more places, was loosened into a fibrous mass, and ulcerated; at a later period there was great destruction of the cartilage, the joint was filled with ichor, the synovial membrane and other parts of the joint disorganized.

Many will not allow the possibility of primary affections of the cartilage, as the cartilages of a movable joint must be considered as lifeless parts, which cannot take on inflammation, do not feel the effect of irritants, and, in affections of the synovial membrane or of the bony tissue beneath it, only suffer destruction and exfoliation. **Schumer** (*a*) has, in his experiments on animals, observed the same results as **Dörner** and others had previously, that the joint-cartilages, laid bare, injured, and even exposed to the air, never showed any trace of inflammation, which appeared only in the bony epiphyses and synovial membrane. **Gendrin** (*b*) supports this opinion especially on the ground of the cartilage not being covered with synovial membrane; an assertion which though also put forth by others is contradicted by observation. J. B. **Marc** (*c*).

According to **Brodie**'s and my own observations, I must consider the disease here described as different from common inflammation of the synovial membrane and of the spongy ends of bones, even although perhaps it does not always arise as a primary affection of the cartilage, but is caused by *partial* inflammation of the synovial membrane, and of the spongy bony tissue beneath the cartilage. **Meckel** (*d*) also supposes that the cartilage in different diseases of the joints may redden, swell, soften, and loosen up, but with this peculiarity, that suppuration is not necessarily connected with their ulceration.

[Sufficient has been already said in the last paragraph to prove, as seems to me, the truth of **Wilson**'s and **Key**'s notion of the deposit of a new and vascular substance upon the synovial membrane being the usual cause of ulceration of cartilage, and that the cause is not in the cartilage itself. It will not, therefore, require again to be adverted to further than to observe that it is quite distinct from the "loosening of the cartilage into a fibrous mass," spoken of in the present paragraph.

This form **Brodie** speaks of thus:—"We find occasionally some portion of the cartilage covering bone, altered from its natural organization, converted into a number of ligamentous fibres, each of which is connected by one extremity to the bone, while the other is towards the cavity of the joint" (p. 113); and as he soon after mentions in the dissection of one such case, "having no lateral connexion with each other" (p. 119); producing the "brush-like projections of the cartilage and synovial membrane," as **Mayo** calls them (*e*). This "conversion of the cartilage into soft fibrous structure," **Brodie** says, "I am disposed to believe is the frequent, though not constant, forerunner of ulceration. In a woman who died a week after a severe contusion of the hip, the cartilage of the hip was found in some parts entirely absorbed, in others having a fibrous appearance, similar to what has been described. And I have noticed the same circumstances in other cases sometimes connected with, and sometimes independent of local injury." (p. 121.) Here, then, is a morbid alteration of structure, the occurrence of which seems to indicate that there must be such a vascular apparatus entering into the formation of cartilages as enables new materials to be deposited and old materials to be absorbed, and without which morbid alterations of structure do not take place in other parts of the body." (p. 113.) **Brodie** (*f*) further observes:—"The degeneration of the cartilage into a fibrous structure is no uncommon circumstance; and I suspect that it is *one* cause of the crackling of the joints, which is not uncommonly met with in persons somewhat advanced in life. I have no doubt that it often exists where it is never followed by ulceration; but I am also well assured that, in many other instances, it precedes, and, in fact, forms, the first stage of the disease." (p. 339.) In regard to this "degeneration of the cartilage of a joint into a fibrous structure," which **Key** holds as a distinct form, and describes as the third mode of ulceration of cartilage, he says:—"As far as my observations have enabled me to judge, it is a disease of a peculiar character, and differing in many respects from the ordinary affection of joints that end in the destruction of the cartilage. I have had but few opportunities of verifying by dissection the

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(*a*) Diss. de Cartilaginum Articulorum ex Morbis Mutatione. Groning. 1836. 8vo.

(*b*) Histoire Anatomique des Inflammations. Paris, 1836. 2 vols. 8vo.

(*c*) Essai sur les Synoviales, Paris, 1834, p. 13.

(*d*) Above cited, *par.* 2.

(*e*) Med.-Chir. Trans, vol. xix. p. 49.

(*f*) Additional Notes.

existence of this disease. **Brodie** has described it, and appears to regard it as a not uncommon occurrence; in one instance he found it combined with disease of the intervertebral substance. Of three cases that have come under my notice, two have occurred in subjects brought into the dissecting-room, and the history of which I was unacquainted with; the other case was that of a gentleman who was labouring under stone in the bladder, and suddenly experienced a severe attack of pain about the head of the fibula and the bursæ at the back part of the head of the tibia. The pain was accompanied with considerable fever, and slight swelling of the parts in which he complained of the pain. On the third day the pain shifted from the fibula to the knee-joint, which swelled, as if from an effusion of synovial fluid. The suffering now became excessive, and the fever assumed a typhoid character. At the end of ten days from the commencement of the attack he died. The bladder presented less evidence of the inflammatory action than might have been expected from the intensity of his sufferings. The knee-joint was distended with a thin opaque synovial secretion, of a somewhat purulent character; the surface of the synovial membrane presented here and there patches of more than ordinary vascularity. The cartilaginous surfaces of the bones were entire, with the exception of a small spot on the end of the femur, which appeared ragged and irregularly broken up into a fibrous mass." (pp. 241, 2.)]

218. This disease shows itself in every age, but especially in children; more frequently in the hip and shoulder than in other joints. Its causes are external injury, but especially dyscratic diseases.

["The ulceration of the articular cartilages may," according to **Brodie**, "occur at any period of life, but it is most frequent in those who have passed the age of puberty, and who are under thirty-five years of age. We meet with it, however, some times in young children, and at other times in old persons." (p. 151.)]

219. The prognosis is always unfavourable, as the disease is often mistaken at its commencement, and speedy destruction of the parts of the joint is produced.

220. In severe irritation of the joint, leeches, cupping, even blood-letting, warm baths, and so on, must be employed at the onset. If the inflammation be thereby diminished, or if the disease has originally taken an insidious course, derivative remedies, and, among these, issues especially and the actual cautery are to be employed. The action of these remedies is often very rapid; the suppuration must, however, be kept up from the surface for a long time, and the joint kept perfectly at rest. Sometimes improvement quickly takes place; but the attacks recur, in which case, probably, suppuration has already taken place in the joint. When abscesses are formed, they must be treated as already directed, and especially the general diseased condition of the body somehow connected with the disease of the joint, properly attended to.

D.—OF THE INFLAMMATION OF THE JOINT-ENDS OF BONES.

221. The inflammation, in these cases, (*Inflammatio Processuum Articulorum*, Lat.; *Entzündung der Gelenk-Enden der Knochen*, Germ.; *Inflammation des Extrémités Articulaires des Os*, Fr.,) begins in the very vascular spongy part of the joint-end of the bone, and is at first accompanied with little pain, which comes on imperceptibly. After a lapse of time of uncertain length, there appears an elastic, irregularly spreading swelling of the outermost parts of the joint, the form of which depends on the expanded joint processes: the swelling is larger when the joint is in action, and smaller when it is at rest. The motions of the joint are little interfered with. After a shorter or longer time, increased pain comes on, the external skin becomes dusky red, and finally breaks; ill-conditioned pus is discharged, and caries is felt on using a probe. So often as some

wounds close, others break out, and hectic fever threatens to exhaust the patient.

[" There is another malady," says BRODIE, " which affects the joints, having all the character of scrofula, generally occurring in persons who have a scrofulous appearance, and usually preceded by, or combined with, scrofulous symptoms. In this disease of the joints, the cancellous structure of the bone is the part primarily affected; in consequence of which ulceration takes place in the cartilages covering their articulating surfaces. The cartilages being ulcerated, the subsequent progress of the disease is, in many respects, the same as where this ulceration takes place in the first instance." (p. 226.) The morbid affection appears to have its origin in the bones, which become preternaturally vascular, and containing a less than usual quantity of earthy matter; while at first a transparent fluid, and afterwards a yellow cheesy substance, is deposited in their cancelli. From the diseased bone we see, in some instances, vessels carrying red blood extend into the cartilage. The cartilage afterwards ulcerates in spots, the ulceration beginning on that surface which is connected to the bone. The ulceration of the cartilage often proceeds very slowly. I have known a knee amputated on account of this disease, in which the cartilage was absorbed for not more than the extent of a sixpence. Occasionally a portion of the carious bone dies and exfoliates. As the caries of the bones advances inflammation takes place of the cellular membrane, external to the joint. Serum, and afterwards coagulable lymph, is effused, and hence arises a puffy and elastic swelling in the early, and an œdematous swelling in the advanced, stage of the disease. Abscess having formed in the joint, makes its way by ulceration through the ligaments and synovial membrane, and afterwards bursts externally, having caused the formation of numerous and circuitous sinuses in the neighbouring soft parts. In one case, thin layers of cartilage were found lying on the ulcerated surface of bone, apparently unconnected with it. In some instances, in the advanced stages of this disease, we find nearly the whole of the cartilage forming an exfoliation instead of being ulcerated. This scrofulous affection attacks those bones, or portions of bones, which have a spongy texture, as the extremities of the cylindrical bones, and the bones of the carpus and tarsus, and hence the joints become affected from their contiguity to the parts which are the original seat of the disease. Sometimes, however, we may trace the effects of these morbid changes even in the shaft of a cylindrical bone; so that we see the femur or tibia converted in its middle into a thin shell of earthy matter, enclosing a medullary canal of unusual magnitude. It has been remarked by a modern author (*a*), that in the last stage of this disease the bones not only lose the preternatural vascularity which they possessed at an early period, but even become less vascular than healthy bone. I believe the observation to be correct; and this diminution of the number of vessels, and, consequently, of the supply of blood, is probably (as this author has suggested) the proximate cause of those exfoliations which sometimes occur where the disease has existed for a considerable length of time, especially in the smaller bones." (p. 245–48.)

Upon this condition, his " last form, in which ulceration (or rather absorption) of cartilage takes place," KEY (*b*) observes:—" There are two forms of disease in bone under which this secondary absorption of cartilage takes place; the one is of a chronic nature; the other assumes an acute form; but in the process of ulceration the same passive condition of the cartilage may be observed as in that which commences within the cavity of the joint.

The *chronic* form is that in which a strumous action takes place in the cancellated structure," (pp. 243, 44,) and is that just described. " I apprehend," says KEY, " that most pathologists will concur in the probability of the loss of the cartilage being effected by means of the vascular granulations that spring up from the cancelli, and appear to form a continuous structure with the surface of the cartilage. In making a transverse section of the joint, under these circumstances, there is no trace to be seen of increased vascularity in the cartilage, nor in the synovial membrane, until the action is far advanced, that can lead us to suppose that the cartilage was ulcerated by any other agent than the vascular tissue of the bone.

The *acute* form of the disease differs from the former in the comparative suddenness of the attack, as well as in the appearance which the bone presents. The former is like all strumous affections, slow in its progress, and at first marked by little or no pain in the part. Months often elapse before the symptoms become severe, and the constitution much affected. But in the acute form of disease attacking the spongy extremities of bones, the pain is often severe in the beginning, the limb at that part tender when pressed, and the constitution a good deal disturbed. A few weeks only elapse

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(*a*) LLOYD on Scrofula, p. 123.

(*b*) Med.-Chir. Trans., vol. xviii.

before the joint exhibits symptoms of participating in the mischief. From this time the disease makes rapid progress: if suppuration takes place in the cavity of the joint, the synovial membrane ulcerates and allows the matter to burrow between the muscles of the limb: fistulous openings at length form, and tend in some measure to abate the patient's sufferings. The effect, however, on the constitution is such that amputation is usually resorted to for the preservation of life. Examination of the joint exhibits very different appearances from those which are observed in the chronic strumous disease of the bone; not in the cavity of the joint itself, for here the process of destruction is in some respects the same; but in the bone the affection is found to be altogether of a different character. The substance of the bone retains its firmness of texture; and when cut through shows no signs of disease except at one part of the cancelli. There a cavity is found containing one or more portions of detached bone, surrounded with pus; this cavity is found to communicate with the joint by a fistulous opening of small size, which may sometimes escape observation. The cancellated structure of the bone surrounding the cavity usually appears natural and sending forth vascular granulations. The cartilage covering the end of the bone is extensively ulcerated in some parts, whilst in others it appears to have undergone no change. The process of ulceration evidently begins on the outside of the joint, for the cartilage, when closely examined, appears to be undermined, and the surface towards the joint where this undermining process is going on seems quite sound. The synovial membrane shows signs of acute inflammation, and its cavity is found to communicate with one or more extensive collections of pus above and below the joint. This form of disease is in its nature analogous to necrosis of the shafts of the cylindrical bones." (p. 245–47.)

"In scrofulous disease of the cancellated texture of the heads of bone," says Goodsir, "or in cases where the joint only is affected, but to the extent of total destruction of the cartilage over part or the whole of its extent, the latter is, during the progress of the ulceration, attacked from its attached surface. Nipple-shaped processes of vascular texture pass from the bone into the attached surface of the cartilage, the latter undergoing the change already described. The processes from the two surfaces may thus meet halfway in the substance of the cartilage, or they may pass from the attached, and project through a sound portion of the surface of the cartilage, like little vascular nipples or granulations. The cartilage may thus be riddled, or it may be broken up into scales of various size and thickness, or it may be undermined for a greater or less extent, or be thrown into the fluid of the cavity of the joint in small detached portions, or it may entirely disappear." (p. 19.)]

222. According to the stage of the disease, the joint ends are found on dissection in different conditions. They are soft, broken up, dusky red; their vessels much enlarged, and the cells of the bone are filled with reddish lymph. The cartilages are often still unchanged externally, but their inner surface is loosened from the destroyed bone. In the most advanced stage, both bone and cartilage are destroyed, the synovial membrane and ligaments disorganized, and the cavity of the joint filled with ichorous pus.

223. This disease is more rare in the hip and shoulder than in other joints, and most frequent in the spongy bones of the wrist and instep. It is more frequent in children and young persons than in adults. Its occasional cause may be external violence, but there is always dyscratic disease, and especially scrofula, in causal connexion with it.

[Brodie says:—"The scrofulous affection of the joints occurs frequently in children; it is rare after thirty years of age. Examples of it occur in almost every joint of the body; but the hip and shoulder appear less liable to it than many other articulations." (p. 248.) But Key states:—"The bones in which he has observed this (the chronic) form of disease are the small bones of the carpus and the extremity of the femur; and, more frequently, the head of the tibia and the bones of the tarsus. Persons of *all* ages appear to be liable to it: I have witnessed it," he says, "in patients from the age of two years to fifty." (p. 244.)

Brodie also further observes:—"As it depends on a certain morbid condition of the general system, it is not surprising that we should sometimes find it affecting several joints at the same time, nor that it show itself in different joints in succession, attacking a second joint after it has been cured in the first, or after the first has been removed by amputation. It is seldom met with, except in persons who have the marks of what is called a scrofulous diathesis; and in many cases it is either preceded, attended, or followed, by some other scrofulous symptoms, such as enlargement of the scrofulous glands of the neck, and mesentery; or tubercles of the lungs. I have often been led to believe that the occurrence of this disease in the joint has suspended the progress of some other, and perhaps more serious, disease elsewhere." (pp. 249, 50.)

Brodie's last observation is, I am convinced, exceedingly correct, if, as I presume, he means some modification of scrofulous disease in other parts of the body. I am certain that I have, again and again, seen persons, whose appearance betokened incipient phthisis, recover, and become stout and healthy; as if the disease had proceeded to its crisis in the joint, and, on the removal of which by amputation, all the constitutional disturbance ceased.—J. F. S.

Brodie considers that "the scrofulous disease is more likely to be confounded with ulceration of the articular cartilages than with any other. There is, in many respects, a correspondence in their symptoms. There are, however, certain points of difference, and I believe that this difference will be found in general sufficient to enable the practitioner, who is careful and minute in his observations, to make a correct diagnosis; at least, in those cases in which the local disease is not so far advanced, and in which it has not so much affected the general constitution as to make the diagnosis of no importance. (p. 250.) The principal difference which is to be observed between the symptoms which have been just described, and those which are met with, where ulceration of the cartilages occurs as a primary affection, is in the degree of pain which the patient endures, and which is much less in the cases of the former (the scrofulous disease) than in those of the latter description. It may, indeed, be matter of surprise that, in cases of this scrofulous affection, the sufferings of the patient should be so little as they are found to be in proportion to the quantity of local mischief. For the most part, the pain which he experiences is not a subject of serious complaint, except at the time when an abscess is just presenting itself underneath the skin, and then it is immediately relieved by the abscess bursting. There is never that severe pain which exhausts the powers and the spirits of the patient in cases of ulceration of the cartilage, except in a very few instances, and in the most advanced stage of the disease, when a portion of the ulcerated bone has died, and, having exfoliated so as to lie loose in the cavity of the joint, irritates the parts with which it is in contact, and thus becomes a source of constant torment. There are other circumstances, besides the less degree of pain, which, although not in themselves sufficient, it is useful to take into the account in forming our diagnosis, such as the general aspect and constitution of the patient, and his having manifested a disposition to other scrofulous symptoms; the very tedious progress of the disease; and the circumstance of the suppuration not being in general confined to a single collection of matter, but producing a succession of abscesses." (pp. 255, 6.)]

224. The prognosis and treatment are the same, as already stated, in inflammation and ulceration of cartilage.

[OF THE FAVOURABLE CONSEQUENCES OF ULCERATION OF THE CARTILAGES.

224.* The termination of ulceration of the articular cartilages from whatever cause, although generally destroying the patient by wearing out his constitutional powers, unless prevented by the removal of the limb, is neither always fatal, nor does the joint or its motions even seem to be always destroyed. When the destruction of cartilage has a favourable issue it terminates in one of two ways. In the *first*, the cartilage is replaced by a layer of ivory-like bone, and the motions of the joint continue; this especially happens in disease of the hip-joint. In the *second*, the opposed ends of the bones are united either by a ligamento-fibrous structure, which permits a slightly yielding motion of the joint, or by bone which precludes any motion, and thus are produced the two forms of anchylosis, viz., the soft and the hard. Whether the one kind passes into the other, I can not positively state, though I think I have seen, in more than one instance, part of the connecting medium ligamento-fibrous and part bony.

I. Of the *ivory-like covering of the joint surfaces of bones.* This condition has been by some anatomists thought to be merely a natural process, the common consequence of age, by which the cartilage thick in youth is gradually thinned in adult age, and finally in advanced life completely removed, bone being stated to be constantly deposited in its place till the whole surface of the joint is thus covered. I think, however, I shall be able to show that this is an erroneous statement, as at the very onset it would appear unlikely that more earthy matter should be deposited. under natural circumstances, upon the ends of bones, so as to give those parts an ivory-like character, whilst on every other part of the same organs less earth is deposited, and even the fibrous mould in which it is lodged becomes thinner and thinner in age.

"The removal of the cartilage from the heads of bones in old people," observes **Key**, "proceeds so slowly that it is difficult to say, on the examination of a joint, whether the action has ceased, or is still in a state of progress. The form of disease to which I allude is attended with a good deal of stiffening of the joint, accompanied by what are termed rheumatic pains. The place of the cartilage is often supplied by a bony deposit, resembling ivory in texture as well as appearance." (p. 242.) **Toynbee** says:—"The articular cartilage is gradually being converted into bone during the whole of life; thus it is thicker in young than in adult subjects; and, as Sir B. **Brodie** informs me, it is much thinner in old age than in the adult: in fact, it is not very rare to find that the articular cartilage of the head of the *os femoris* in very old persons has completely disappeared, a change which is probably to be attributed to its entire ossification." (p. 167.)

That this is merely a natural process as might be inferred from **Toynbee**'s observation cannot be admitted; were it so, the disappearance of the cartilage and the ivory-like covering of the joint-end of bones would be much more frequent than it is. It is quite true that the cartilages of elderly people are much thinner than those of young persons; but this does not depend on their conversion into bone, for the shell of bone in the aged is commonly as much attenuated in comparison. It ought also to be commonly happening in all joints, which is far from the case, as it is but rarely found except in the hip-joint. For these reasons I think **Brodie**'s opinion is correct, that "it is probable in these cases the original disease had been ulceration of the cartilages." And especially as he mentions what appears to me to be the two stages of this ivory-like appearance, the *first* being that which he speaks of as having "many times in dissection observed a portion of cartilage of a joint wanting, and in its place a thin layer of hard, semi-transparent substance, of a gray colour, and presenting an irregular granulated substance;" and the *second*, that in which "no remains of cartilage were found on the bones of one hip; but, in its place, a crust of bony matter was formed, of a compact texture, of a white colour, smooth, and having an appearance not very unlike that of marble." (pp. 204, 5.) The difference of the two appearances seems to me easily explained by the continual motions in the joint wearing down the irregular granulated surface till the white, smooth, marble-like condition is produced. That it is also a consequence of absorption of the cartilage I think is further proved by the expansion of the articular surfaces, which is very often noticed in the hip-joint under this form of disease, both the head of the thigh-bone and its socket being also flattened; which flattening and spreading of ball and socket, or of hinge-joints, very frequently occurs with ulceration of cartilage without any ivory-like deposit, and as commonly when soft anchylosis exists. This then is the first and most favourable result of ulceration of cartilage, in which the motions of the joint are not materially impaired.

II. Of *Anchylosis*.—"This is an union of bone with bone," says **John Hunter** (*a*), "which ought not to be united, and is of two kinds, one by soft parts, the other by bone. In inflammations of joints we often have adhesions by a soft medium. Very considerable inflammation is necessary to produce anchylosis in joints, and much time is necessary for their perfection, as we see in white swellings. The adhesions are sometimes partial, sometimes universal. The soft is from two modes, viz., adhesion and granulation. The soft only can take place where there is naturally no intermediate substance, and the joint is surrounded by capsular ligament. Bony anchylosis I shall divide into five kinds, four of which are in the surrounding parts by ossific inflammation, the other by an entirely new substance between the extremities of a bone." (p. 521.) With the first four kinds we have at present nothing to do, but the fifth kind is the immediate object of our attention, viz.,

Anchylosis effected "*by the whole substance of the articulation.*"

This is of two kinds, and these are the only ones which can admit of the soft anchylosis. It is somewhat similar to the union which takes place in soft parts; it arises from two causes, 1*st*, from inflammation of the parts themselves; 2*ndly*, from the inflammation of the surrounding parts, the parts themselves partaking of it.

From the *first cause*, or inflammation of the parts themselves, arises "*suppuration in*

(*a*) Lectures on Surgery, **Palmer**'s Edition.

joints producing anchylosis. This is of two kinds," says **Hunter**, "viz., the truly inflammatory, and the scrofulous; the former we shall now treat of.

"If the inflammation be carried on, an abscess is formed in the cavity as in any other part; and the suppuration is more universal in the cavity than in other parts, being diffused through the whole. This continues to approach nearer and nearer the external surface, and either breaks or may be opened. So far as they are connected with bone, they are similar to compound fractures, but the suppuration is slow, and takes place with difficulty, and then generally falls into the natural scrofulous disposition, which renders it tedious. The suppuration is then imperfect, appearing to partake of both the adhesive and suppurative. The ulcerative disposition is slow in bringing the matter to the skin, which arises from the indolence of the prior suppurative disposition and inflammation. The ulcerative inflammation sometimes goes on, so as entirely to alter the joint, that is, the receiving cavity becomes larger and the received part less; this is often the case in the hip-joint. These cases then become very tedious, and generally very uncertain in their cure. Before they are opened they are generally become so indolent that opening has very little effect, and often, when scrofulous, such a disagreeable inflammation comes on as to destroy the patient, and therefore amputation had better be performed at once, if this disagreeable inflammation does not take place immediately after opening; yet a fistulous opening is generally the consequence.

"*Soft anchylosis from granulations.*—A joint so healed has no cavity left; the surfaces uniting. A joint coming to suppuration from not being resolved in the first mode, but forming granulations, is more tedious than in the soft parts, and the powers of restoration in them are very weak.

"*Bony anchylosis* takes place when the granulations ossify, so that the two bones are united into one, exactly similar to a compound fracture. But when the suppuration is healthy the joints sometimes recover; in such cases the matter is sooner discharged, and the parts are more disposed to return into their original state." (pp. 522, 23.)

Such is **John Hunter's** account of this important process, to which, however, some exceptions must be made. He seems to wish it inferred, that anchylosis generally results from suppuration of joints, for he has elsewhere observed, that "Nature is very little disposed to take on adhesive inflammation, because the necessary consequence would be loss of motion in a part originally intended for motion." (p. 519.) And that granulations as the consequence of suppuration produce anchylosis either soft or bony. I am not, however, disposed to assent generally to these statements, though I would not deny their occurrence as exceptions.

In the first place, as regards the frequency of *Soft Anchylosis from granulations* following suppuration, I feel assured, from frequent observation, that soft anchylosis is produced by the adventitious membrane poured out during inflammation of the synovial membrane, which, as **Key** (*a*) says, "produces ulceration of the contiguous cartilage," (p. 224,) and, "when the cartilage has been wholly absorbed, and the ulcerative process has been checked by the inflammation being arrested, serves another purpose: it becomes the medium of union between opposed surfaces of bone, or the means of anchylosis. Long after all inflammation has subsided, one of the condyles of the femur is often found adhering to the tibia by means of this membrane, which appears white and ligamentous, a layer of cartilage often remaining between the membrane and the bones, as if the process of ulceration had been arrested." (p. 226.) And I believe, most commonly, when the soft anchylosis so originating is completed, that no suppuration in the joint takes place, and that, when it does happen, it results from recent inflammatory action assuming the suppurative character, and set up by external violence, which, destroying the cartilage down to the surface of the bones, these also ulcerate; and then, if there be sufficient constitutional power, the bones produce the granulations, and these inosculating, union of the opposed surfaces is produced, as seen in **Mayo's** case below, (p. 246,) and as in compound fracture, by deposit of earthy matter in the granulations, and thus bony anchylosis is brought about. I think this will be shown to be a correct view of the subject on examination of the cases which will be presently mentioned. Hip disease, which is also almost invariably attended with suppuration, and more or less complete destruction of the cartilage, and even of the head of the thigh-bone and its socket, seems to me a further proof of the opinion I have advanced, as at that joint soft anchylosis is very rare; whilst, on the contrary, bony anchylosis, if the patient's strength enable him to battle out the disease, is almost the constant favourable issue of the contest.

Key states, that "the formation of the vascular membrane frequently takes place without suppuration, as may be seen in strumous joints that have been the subject of chronic inflammation for years, without abscess having formed; and the inflammation

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(*a*) Med.-Chir. Trans., vol. xviii.

is sometimes confined to one side of the joint. Such joints are sometimes seized with an acute attack of inflammation of that part which had been previously healthy; suppuration rapidly ensues, under which the failing of the patient's health and powers demand amputation of the limb for the preservation of life. The two sides of the joint present different appearances: one shows no recent signs of inflammation; the ends of the bones are partially, perhaps wholly, deprived of their cartilage, or the cartilaginous surface is ulcerated only to a certain depth; between the bones is seen the membrane adhering to the cartilage, white, possessing scarcely a trace of vascularity, and merely serving to connect the ends of the bones by means of what is termed ligamentous anchylosis. The other side of the joint is full of pus; every tissue in a state of active inflammation; the cartilage removed by a rapid process of ulceration, in which the bone is probably found to have taken an active part; and the ends of the bone are seen covered with vascular fungous granulations, from which pus is abundantly secreted." (pp. 227, 28.) With the correctness of these remarks I fully concur, and the following instances well support them, excepting that, in the first, the pus had been discharged, and, in the second, ulceration had occurred without suppuration.

Case 1.—B. S., aged nine years, a fair-haired strumous boy, became my patient in June, 1840. Five years ago he was attacked with swelling and lameness of the left knee, without any known cause; he was put under medical treatment, and afterwards was admitted into the hospital, from which, about four years since, he was discharged; and it may be presumed all active disease had ceased, as his mother was told that the knee, which had become much bent, with the heel much raised from the ground, would be restored, as his health recovered. No such improvement, however, has taken place, and he has since gone about constantly on a crutch. Being a very active boy, he has frequently got falls, and hurt his knee; which, however, in the course of a few days have been recovered from. Within the last two months he has fallen twice, but has not got well as previously; and though during the day his knee has been little painful, yet at night it has become so much so as to prevent his sleeping.

The leg is now bent nearly at a right angle with the thigh; it can be bent a little more, but not straightened; the great toe only touches the ground, but he cannot bear upon it. The knee is rather larger than natural, especially the inner condyle; and both condyles project a little over the front of the head of the shin-bone. There is a little fulness above the knee-cap, as if the joint were distended; but there is little tenderness, and gentle motion does not cause pain.

During a month nothing was done except keeping quiet; and it was observed that, if he did not move about during the day, he had not any pain at night. The joint then seeming to be perfectly free from irritation, I thought it advisable to attempt straightening the leg, sufficient to bring the foot down and render the limb useful. A hinge-splint, adapted to the bent state of the limb, was, therefore, adjusted to the back of the leg and thigh, which it was purposed slowly to extend by a screw, the two ends of which were affixed to the two portions of the splint. This practice was continued for some weeks without benefit; but swelling coming on, attended with pain and tenderness, it was discontinued, and amputation successfully performed in the September following.

On examination, the whole joint was found largely covered with fat; and immediately above the knee-cap an abscess, about the size of a shilling, communicating with the joint below the front of the outer condyle by a narrow passage an inch long, lined with adhesive matter, but not containing pus. There is not any dislocation, but mere bending of the leg upon the thigh-bone. The cavity of the joint was destroyed, and the opposed bony surfaces united with fibrous matter, but some of the cartilage still remained.

Case 2.—J. P., aged nineteen years, a dark-haired scrofulous lad, came under my care in November 1839. Eight years ago, whilst running, he felt a sudden snap in his left knee-joint, and almost immediately a swelling appeared above the base of the knee-cap, rather larger than a pigeon's egg, but unattended with pain. This on the following morning had subsided, but another swelling presented itself on the inside of the ham, which was at once blistered by his medical attendant. On the next day he was attacked with bilious fever, which confined him to bed fifteen weeks, and reduced him very much; but during this time he did not suffer any pain or inconvenience in his knee. Soon after getting about, the knee began to swell and to become stiff, but unaccompanied with pain, and not preventing his walking. Leeches were once applied, and an evaporation lotion used, but nothing more done; and at the end of a twelvemonth, the knee having become fixed in a straight position, he was told he had a white-swelling, and the removal of the limb advised, to which, however, he would not submit. His health continued improving, and he walked about with the aid of a stick, without pain, or further inconvenience than a little halting, as late as July last, when he took a walk of fourteen miles without annoyance. At the latter end of the following month (August) he slipped on a stone, and fell on his side, at the same time bending the previously fixed knee. At the moment he had little pain; but when he went to bed the pain came on, and has recurred nightly ever since. Little swelling followed, but he could no longer bear on the limb without pain, which was also excited when pressure was made on the knee-cap. On first getting up in the morning, the leg shakes very much, and causes great pain in the knee; but both subside in a few minutes, and he has not any more pain till he again goes to bed, when it recurs, and much disturbs his sleep. His general health is good.

The knee-joint is now but little enlarged, and there does not appear to be any fulness from fluid in the joint. The leg is partially bent, the condyles of the thigh projecting much over the head of the shin-bone, and the knee-cap seems nearly fixed on the front of the outer condyle. The whole knee is generally tender, but especially upon the inner side. When the bones are pressed together he suffers pain, and a slight grating is felt. Amputation was performed, and he recovered.

Upon examination, the whole exterior of the joint was found covered with much fat, especially in the ham, and on the inside of the tip of the knee-cap was a small abscess, containing a tea-spoonful of thick greenish-yellow pus. Within, the knee-cap was found adhering by bone to the outer condyle of the thigh-bone, and the latter was connected by fibrous tissue with the outer articular surface on the head of the shin-bone; but the greater portion of the hind part of the condyle was absorbed. The cartilage upon the inner condyle was partially destroyed, and the surface of the bone exposed; upon the corresponding part of the head of the shin-bone the cartilage was almost entirely destroyed, and the bone itself ulcerating.

Whether the fibrous anchylosis be the first step to bony anchylosis, I am not prepared to say; but the following instance in which the limb was amputated between thirty and forty years after the motion of the knee had been destroyed, for necrosis in the condyle, produced by a comparatively recent injury, would lead to the belief that the two diseases were distinct.

Case 1.—S. D., aged fifty years, a sickly woman, came under my care in October, 1839. When ten years old she fell down an area on her right knee, which immediately swelled and became painful; suppuration ensued, and pus having been discharged on the outside of the thigh and knee, after a time she got comparatively well, being able to tread on the entire sole of the foot; but she has never since had free motion of her knee, though capable of bending it to some extent. Twenty-three years since suppuration of the joint again occurred shortly before one of her confinements, and from that time a sinus on the fore and upper part of the inner condyle has continued discharging. Three years ago she received a blow with a heavy boot, just above the knee-joint, which suppurated and burst, an inch or two above and on the outside of the base of the knee-cap. From this time her health failed, and, though after lying in bed for nine months she was able to go about her usual occupations, yet during the last year the pain in the knee again became so severe that she has been constantly confined to her bed. She has now one sinus near the outer hamstring, a little above the knee-joint, and other three about the inner condyle, from which there is a free discharge. The condyles project forwards, as if the ligaments of the knee had given way, and partial dislocation had taken place. Motion of the knee-joint does not cause much pain, but she has frequent dull aching pain just above the knee, both day and night, which occasionally extends up to the hip, and is brought on whenever attempts are made to put the foot to the ground. Her health is much broken; her appetite bad, and she gets but little sleep. Under these circumstances, amputation above the knee was performed, and she did well.

Upon examination, by making a vertical section of the bones, the recent disease was ascertained to consist in a sequestrum as large as the top of the thumb in the expanded part of the thigh-bone, which was enlarged just above its articular surface; the front of the shell of the bone was here absorbed, forming an aperture as big as a sixpence, which communicated with the wound above the knee-cap, and with the lower wound on the inner condyle; the sequestrum, which was quite loose in the cancellated structure of the bone, might have been easily removed by dilating the former wound. The popliteal space of the thigh-bone was quite bared of its periosteum, and communicated with the upper two wounds in the inner condyle. Of the *primary disease* there were the following traces:—The joint surfaces of the thigh and shin-bone connected by fibrous structure; the front of the head of the latter destroyed, and in its place a patch of fibrous matter; the bottom of the condyles destroyed, and in several parts the remaining articular surface deprived of its cartilage; both condyles were partially dislocated forwards upon the head of the shin-bone. The semilunar cartilage remained on the outer, but not on the inner side. The knee-cap was not anchylosed.

The following is a similar instance, but of much shorter duration, and strengthens my opinion of the long existence of the fibrous structure just mentioned.

Case 2.—E. B., aged thirteen years, a fine boy, but of strumous appearance, became my patient in December, 1839. Five years since, but without any injury, he had some affection of his right knee-joint, accompanied with much pain and drawing up of the heel, so that he could not put the whole sole of his foot upon the ground. He was not, however put under medical treatment till the lapse of six months; but the knee became more and more bent, and about two years since the leg was so much drawn up that the foot would not reach the ground. About this time an abscess, doubtless connected with the joint, burst just above the outer condyle, from which pus was freely discharged, and the pain he had previously suffered diminished. The wound became sinuous and has so continued to the present time.

The leg is *now* bent upon the thigh at an acute angle, beyond which it cannot be straightened, though it may be bent up to the thigh with a little pain. The condyles of the thigh-bone project in front of the head of the shin-bone, which rests entirely on the hind articular surfaces of the former. The knee-cap is sunk between the condyles, and between it and the head of the shin-bone is a large fluid cushion, painful on pressure, and occupying the place of the ligament, which seems completely destroyed. Upon the inside of the knee there is also tenderness.

Amputation above the knee was performed, and he did well.

On examination of the joint, a sinus was found extending around the outer condyle to the knee-cap, behind which was some scrofulous matter. All the articular surfaces were connected by fibrous structure, but some portions of cartilage still remained. Within the epiphysis of the head shin-bone was a small portion of dead bone, but not communicating with the joint.

That soft or fibrous and bony anchylosis may occasionally, though rarely, happen at the same time I do not deny, as they are shown to do so by the following

Case.—J. M., aged forty-two years, a stout healthy sailor, was put under my care in May, 1838. Two years ago he was attacked suddenly twice or thrice, without assignable cause, with numbness of the left leg and knee, and inability to stand upon it for four or five minutes, after which he moved about as freely as usual. In August of the same year he caught violent cold, was very sick, and his knee began to ache constantly, accompanied with shooting pain. Soon after he was unable to bend the joint at all without excessive pain. In the following month, his leg having become perfectly straight and incapable of motion without great pain in the knee, the inside of which was very tender, he was admitted into the hospital. He was then freely leeched, cupped, blistered, and had his mouth kept sore for a long while. Under this treatment the active stage of the disease passed by, but the leg gradually became half bent by his own effort to render his position more easy, and I could not ascertain whether it could be then straightened. It was however determined to attempt anchylosis in the bent posture, and the limb was therefore put on an Amesbury's apparatus, where it was kept for several months. In the May of the year following, anchylosis being presumed to have taken place, the apparatus was removed, and he walked on crutches, the toe touching the ground; but he could not bear on it without having pain in the knee. As his home was at the sea-side it was thought advisable that he should go there; but after remaining about six weeks, he came up to another hospital where he continued for three months, during which time a screw apparatus was applied for the purpose of straightening the limb, but no benefit resulting, he went home in the following September.

He has now come to me to have amputation performed, as though the joint is quite fixed and but little larger than the other, he is still unable to walk without crutches, cannot bear upon the limb, and if he accidentally strike the toe, has severe pain in the knee. His general health good. On the second of June I amputated through the thigh, but he died three weeks after of peripneumony and ulceration of the mucous membrane of the bowels.

On dissection of the joint it was found covered with fat, and the ligaments had degenerated into a sort of half-fatty, half-cartilaginous structure. A vertical section made on the inner edge of the knee-cap and from before to behind presented a firm anchylosis, which appeared bony on the sides, and specially on the inner side of the joint. The hinder half of the condyles being destroyed and the knee half bent, the thigh at its truncated part rested on the head of the shin-bone, but not immediately, as a quantity of dense fatty fibrous tissue was interposed between them. This new structure was about half an inch thick behind towards the ham, but in front it thinned and became sharp, so as to have a wedge-like shape. Where the articular surface remained there was a thin layer of cartilage. The knee-cap was anchylosed by bone to the outer condyle, but its edge, where unapplied, still exhibited a trace of cartilage. On clearing off the half-fatty half-ligamentous structure into which the ligaments had been converted, the ends of the bone were found close together and not separated as within. There was a slight indication of cartilage between them on the exterior, but on the interior of the joint the union seemed to be bony. The posterior ligament was undistinguishable, being involved in the fibrous mass between the thigh and shin bone. In front of the thigh-bone at top of the pulley for the knee-cap, there was a slight remnant of what was probably synovial membrane, but it was little vascular.

Of the *second cause* or inflammation of the surrounding parts, in which the parts themselves partake of it, JOHN HUNTER gives the following

CASE.—A lady had an inflammation come on from the opening of a sacculus mucosus on her elbow, which inflammation was very violent and extended to the joint, soon after which she lay in and died of puerperal fever. On opening the joint, soft union was found to have taken place, which, if she had lived, would probably have become bony, and the joint would have been anchylosed, merely from adhesive inflammation." (p. 522.)

The following very similar instance is given by MAYO (*a*):—

CASE.—" A young man had a lacerated wound of the ankle; ten days after erysipelas had supervened, and matter had formed about the joint; the integument sloughing, an opening could be seen into the fore and outer part of the ankle-joint, the cartilage of which became rapidly absorbed. The patient suffered severe pain, which he described as gnawing, throbbing pain, with occasional violent shootings through the joint, and a distressing sense of grating when the limb was disturbed. The patient's strength declining rapidly, amputation was thought necessary. The limb was removed two months after the accident.

" Upon a vertical section being made of the ankle, one common change was found to have taken place in both the joints, which the upper and under surfaces of the astragalus contribute to form. In each of these joints the cartilage had entirely disappeared; and the denuded ends of the bones were joined together by a layer of semitransparent and organised lymph, from a sixth to a quarter of an inch in thickness. This union by lymph was a step towards union by bone. One circumstance appeared to me of peculiar interest. The interior of the bones was perfectly healthy, but the surfaces to which the lymph adhered, were for the depth of one or two lines, extremely vascular. They combined with that vascularity the roughness of surface and softness of texture described as found upon the articular aspect of bone in the third kind of ulceration of cartilage, specified above. (p. 228.) I conclude, from hence, that long anchylosis may, under favourable circumstances, take place after that form of ulceration of cartilage, which depends upon inflammation of the adjacent surface of the bone." (pp. 68, 9.)

Bony Anchylosis may occur in any joint, either by the conversion into bone of the cartilages forming symphyses, as in those connecting the pelvic bones together, which can scarcely be called disease,—1st, by the conversion of ligament and fibro-cartilage, as in the anterior and crucial ligaments, and the intervertebral substance of the spine, which scarcely at all differs from ossification of the symphyses just mentioned, instances of which are far from uncommon in elderly persons as regards all the vertebræ, except the two uppermost, which, however, in very rare cases, are also in like manner not only united by bone to each other, but also to the occipital bone, of both which conditions we have examples in St. Thomas's museum; in these the articular surfaces have been deprived of their cartilages either by ulceration or ossification, and the true joints destroyed by bony union: 2dly, by conversion of the ligamentous capsules alone into bone, the contained joints still existing; this occurs in the capsules of the articular processes of the vertebræ, and is not to be confused with that just mentioned. I am not aware that it happens on any other joints. One or other, or all these forms together, are found in elderly persons.

But the most important form of bony anchylosis is that which I have mentioned above, and produced, as I believe, from the granulations of the joint-ends of bones, the cartilaginous covering of which, as well as the articular surfaces, having been destroyed by suppuration, whether arising from acute or from scrofulous inflammation; and thus circumstanced, " the two bones are," as JOHN HUNTER observes, " united into one exactly similar to compound fracture." This kind of anchylosis is undoubtedly most common in the hip-joint, where the inflammation seems to run more readily into suppuration than in any other joint; it is next frequent in the bones of the wrist and instep, but least usual in the elbow, knee, and shoulder; indeed, as regards the latter, anchylosis is, under any circumstances, rare. Instances of anchylosis, even of the lower jaw to the temporal

(*a*) On Ulceration of the Cartilages of Joints, and on Anchylosis; in Med.-Chir. Trans., vol. xix.

bone, have been mentioned by the older writers; and of late, CRUVELHIER (*a*) mentions the case of an old woman who had anchylosis of the right condyle of this bone, the result of a blow received when a child.

In these cases the greater part, if not the whole, of the articular surfaces are removed, and the cancellated structure seems continuous from the one to the other bone.

Other kinds of anchylosis are mentioned, as where bones are fractured into joints; but, so far as my observation has gone, I have not noticed this fact. It is quite true that often when a fracture extends into a joint, the motions of the latter are destroyed, but this generally depends on the displacement of the joint surfaces. Anchylosis is also said to occur when, from any cause, a limb has been kept in one position for several years, and the attitudal penances of the Indian fakirs have been quoted as examples; I presume, however, that in these cases there is not union of the joint surfaces, and that the fixation of the joint simply depends on the rigidity which the muscles have acquired from being long retained in the same position, instances of which, though in minor degree, are of daily occurrence, in the stiffness of uninjured joints which have been long kept in one posture during the cure of fracture, and to restore their perfect freedom of motion is often a very tedious process, and occasionally even not to be effected.

As regards the *treatment* of anchylosis, if it be of the soft or ligamento-fibrous kind, attempts for its relief may be made either by passive motion or by the use of a hinge-splint, the hinge of which is to be placed in the bend of the joint, and its two parts bandaged to the corresponding members of the limb, which is very slowly to be moved, two or three eighths of an inch daily, as the patient can bear it, by means of an iron rod, each end of which is provided with a male screw acting in a female screw, sunk in a movable but shorter rod attached to each portion of the splint; or passive flexion may be performed frequently during the day with the hand alone. In employing either method, however, special care must be taken to relieve the stress on the joint by taking off the apparatus, or to leave off passive motion, whenever pain occurs in the joint, as that indicates at least a disposition to inflammation, which, if increased, may be productive of very serious consequences.

As adjuncts to these immediate remedies, covering the joint with warm brewer's grains, or friction, may be employed to promote relaxation; but, if pain be excited by either, it must not be persisted in.—J. F. S.

VELPEAU (*b*) has considered ably, and at great length, the treatment of complete anchylosis in reference to the three modes proposed for its relief, viz., 1st, the cutting out a wedge-shaped piece of bone; 2ndly, the establishment of a false joint; 3rdly, the violent and sudden rupture of the anchylosis.

The *first* operation was proposed by BARTON (*c*), one of the surgeons to the Pennsylvania Hospital, Philadelphia, U.S., performed a bold and successful operation for the relief of an anchylosed hip, in a young sailor who had fallen down a ship's hold, and had not any surgical assistance for seven months. The injured thigh, which was the right, was bent, with the knee drawn across the left femur; the outer edge of the foot was placed forwards, and the sole turned outwards, which circumstances led to the presumption of dislocation; but there was so much swelling and so great pain on making any attempt to discover it, that it was left alone. After these symptoms had subsided the limb was put in an apparatus for some weeks, but no relief was obtained, and anchylosis took place. After the lapse of a year BARTON determined to attempt an artificial joint, for which purpose he made in the upper part of the thigh an incision six or seven inches long, with its middle corresponding to the great trochanter. A second incision was made across the centre of the former at right angles, and four or five inches in length. The cuts were continued down to the bone, so as to expose its front and hind part between the great and little trochanter, after which the bone was sawn through between the great trochanter and the neck. The limb was then readily restored to its natural position, and found to be only half an inch shorter than the other. The case did extremely well, and, at the end of four months, the patient could walk a considerable distance, and he could by that time carry the foot twenty-four inches forwards, twenty-six backwards, twenty laterally, and rotated it six inches inwards or outwards. The same operation was performed a second time (*d*), with success, by BARTON, on a young physician, but on the lower part of the thigh, for anchylosis of the knee; and subsequently by GIBSON of Philadelphia, also in anchylosis of the knee.

The *second* operation consists "in laying bare the bone, and sawing it in such a way as to interrupt its continuity; and, for the purpose of preventing union, it must be

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(*a*) Anatomie Pathologique, livr. ix.

(*b*) Leçons Orales de Clinique Chirurgicale, vol. ii.

(*c*) North American Med. and Surgical Journal, April, 1827.

(*d*) Archiv. Gén. de Méd., 1838, p. 357.

slightly moved from time to time, and all other means used likely to produce a false joint; by degrees the two ends of the bone grind against each other, and the movable end rounds and becomes blunted, whilst the other hollows slightly. The muscles soon adapt themselves to this new joint, and in the end permit the patient to use the limb as previously." **Velpeau** is favourable to this operation, from the motions occurring in false joints caused by ununited fractures. "As to the danger of the operation," says he, "it is much less than those of amputation or resection of the bone." (pp. 200, 201.) Two operations of this kind have been performed with success upon the thigh; the first by **Barton**, in 1826, who cut through and detached all the soft parts about the great trochanter, and then divided the bone with a small saw; after which the limb was placed on **Dessault's** extending splint. The second was performed by **Rodgers** of New York, in 1830, and also did well.

The *third* operation, viz., that of breaking through the anchylosis, was practised and recommended by the older surgeons; but **Velpeau** does not favour it, and mentions a case, referred to by **Amussat** (*a*), of anchylosis of the knee-joint, in which "an attempt was made to restore motion by bending the leg suddenly upon the thigh. A painful cracking was immediately heard in the knee, and very soon alarming abdominal and thoracic symptoms occurred, which in a few days destroyed the patient." **Velpeau** thinks that "if the union be but slight, or so dispersed that some little motion is permitted, prudence allows the anchylosis to be broken either suddenly or gradually; if the deformity be so great as to render walking or standing impossible without assistance, but not if the contrary be the case; * * * the rupture of the anchylosis being then, really difficult to effect, dangerous, and success by no means certain, as there is always a tendency to the reproduction of union. * * * Attempts only are justifiable when the limb is in such a state of flexion or deviation that its use is prevented. And if the patient earnestly require it, the operation may be performed, *but never if the knee-cap adhere to the thigh-bone.*" And he well observes that "the adherence of the knee-cap to the front of the condyles of the thigh, when existing alone, does not appear to have sufficiently attracted the attention of practitioners. The action of the extensor muscles of the leg is destroyed thereby, and thus the flexors, deprived of their antagonists, gradually drag the head of the shin-bone into the ham, and bend the leg. It matters little that the mobility of the rest of the joint remains, or that it is by any means restored, the anchylosis of the knee-cap continues an insurmountable obstacle to the restoration of the functions of the knee-joint. (p. 204–206.) When the knee-cap is movable, and there is simply false anchylosis, the subcutaneous division of the ligaments or tendons is preferable to the sudden rupture of the anchylosis, because it is infinitely less dangerous and painful, and has at least as favourable a result. * * * If it be a true anchylosis, it would be better, in the greater number of cases, to do nothing at all. It may, however, be necessary, for some reason or other, to choose between the violent and sudden rupture, the wedge-shaped section of the bone, and the establishment of a false joint. Of the latter two operations I have already spoken. As to the rupture, if the soldering of the knee-cap is such as to render dislocation of the shin-bone backwards very probable, we should only operate at the urgent entreaty of the patient, and after having laid before him or his friends the chances of what may happen. This operation is indicated if the flexion be not directly at a right angle, if the knee-cap be not so fixed as to leave little hope of its being detached, or if even it be so situated that, notwithstanding its union, the shin-bone can be brought back beneath the thigh-bone." (pp. 234, 35.)

The apparatus (*b*) by which the rupture of anchylosis is effected was invented by **Louvrier**, and is thus employed:—"The patient, seated on a padded table, is confined in that position by a laced thigh-bandage, fastened to the front of the table by a strong strap, and to the thigh by the lace and some straps and buckles, the thigh being protected from pressure by wadded pads, and a roller lightly applied. The foot is then enclosed in a half boot, laced in front, the sole of which, near the heel, has a metal mortise of two inches, to receive the middle of a metal bar, seven or eight inches long, having at each end a little copper wheel, by which, during the extension, the leg can be directed on a double inclined ascending plane. In the groove of the mortise is attached and fixed one of the pulleys of the winch upon which the extending cord is wound. The thigh and leg are then to be confined in a sort of leather gutter, which is closed in front by straps and buckles, and has on each side, long stout steel splints, those on the outer side jointed together at the top of the knee, and taking at first the same angle as the anchylosis, the one corresponding to the thigh and the other to the leg; the inner splints are also similarly connected. To render his apparatus most effective,

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(*a*) Revue Médicale, vol. ii. 1831.

(*b*) Dictionnaire des Dictionnaires de Médecine, vol. i. 8vo. Paris, 1840.

Louvrier thinks it necessary to make upon the thigh, at the knee, direct pressure from before backwards, and to push it in that direction, whilst the leg is extended. This is effected by means of two uprights fixed on each side of the knee, by their lower ends upon the splints, the four upper ends of which are connected by a rectangular parallelogram, in which they are enclosed and retained by copper nuts. A thick pad is placed on the knee, and, between the metallic rectangle and this compress, a cushion formed of a plate of metal, and padded towards the thigh. The limb thus fixed is placed in a rectangular wooden gutter, at the end of which is a winch; within these planes is a chase, on which the foot, supported laterally by the bar attached to the sole, travels. A set of cords attached to these parts connects them with the winch, and with a few turns of its handle, the leg is straightened always in less than a minute, and most commonly, when the anchylosis is angular, with one or two distinct and successive cracks." (p. 396.)

Velpeau evidently is no favourer of this apparatus; and he enumerates among the objections to its employment, the severe pain, but as this is very short it may be borne with; and the violent purulent inflammation of the joint which may ensue, the danger of this, however, is exaggerated. But the more serious accidents are laceration of the integuments of the great arterial or venous trunks; of the nerves and ligaments; and the more or less severe bruising of the soft parts, in consequence of which sloughing occurs. "If, however," says he, "we observe the cases (about twenty) on which Louvrier has operated, there are but few in which symptoms, more or less serious, occur immediately. I know, however, that these facts are still too few; at present we may presume that this plan of treatment is not so dangerous as one might be led to suppose." (p. 208–15.) To the question "What benefit is the patient to derive from this treatment?" Velpeau replies, as regards the re-establishment of the motions of the joint, that neither theory nor Louvrier's facts are favourable. To prevent the reunion of the bone frequent motion must be resorted to, which is dangerous; but if not employed the bones become resoldered, and the leg either becomes straight, with the sole of the foot flat on the ground, (which is the most favourable result,) or the limb continues more or less bent, and the foot cannot be put flat, so that the patient needs crutches. Another result is, that the head of the shin-bone is thrown behind the condyles, and dislocation is produced, as, if the knee-cap be soldered to the fore and lower part of the condyles, which is often the case, it prevents the head of the shin-bone resuming its natural place, and, serving as a wedge, pitches the latter into the ham, so that a dislocation being produced the patient is not benefited by the operation. (p. 215–17.)

HYSTERICAL AFFECTIONS OF THE JOINTS.

Hysterical females are often subject to affections of the joints, especially of the hip and knee, which, without any actual disease in the part, produce excessive suffering, and are liable to be mistaken for dangerous ailments. Brodie, in reference to this point, says:—"At first there is a pain referred to the hip, knee, or some other joint, without any evident tumefaction; the pain soon becomes very severe, and by degrees a puffy swelling takes place, in consequence of some degree of serous effusion into the cells of the cellular texture. The swelling is diffused, and in most instances trifling; but it varies in degree; and I have known, where the pain has been referred to the hip, the whole of the limb to be visibly enlarged from the crista of the ilium to the knee. There is always exceeding tenderness, connected with which, however, we may observe this remarkable circumstance, that gently touching the integuments in such a way as that the pressure cannot affect the deep-seated parts, will often be productive of much more pain than the handling of the limb in a more rude and careless manner. In one instance where there was this nervous affection of the knee, immediately below the joint there was an actual loss of the natural sensibility; the numbness occupying the space of two or three inches in the middle of the leg. Persons who labour under this disease are generally liable to other complaints, and in all cases the symptoms appear to be aggravated, and kept up by being made the subject of constant anxiety and attention." (pp. 339, 40.) In an affection of this kind in the knee, Tyrrell (a) observes:—"The point which convinced me that the affection was not one of actual inflammation of the ligaments of the knee, but a sympathetic disease depending on the peculiar condition of the constitution, is this, that if she had inflammation merely of the internal lateral ligament and the posterior ligament, the pain would be confined to those parts, particularly when the limb was at rest, and she would complain of pain particularly on pressure on those parts; but when you examined the surface of the joint, it mattered little where you pressed, it was all the same, she complained of pain." (p. 316.) Bell (b) mentions a very remarkable case of hysterical affection, "in which there was great difficulty of discovering whether there was actual disease or not, in which the pelvis was pitched obliquely, as if there were disease in the hip. But there arose a class of symptoms which pointed to the right source, a singular contraction and retraction of the leg, so that the knee was bent almost to the bursting of the ligaments, and the foot turned in so extraordinary a manner, that the great toe lay close to the anus. The retraction was so powerful that we naturally apprehended that the ligaments of the joint must be destroyed. It proved to be a case of hysteria, and, what was extraordinary, was the resemblance it had in every feature to the disease of the hip-joint." (p. 297.) Coulson also mentions a case which he saw in St. Bartholomew's Hospital, in which "the patient was twenty-eight years of age, and had suffered from hysterical affections for ten years. The right heel was doubled under the thigh, the heel rested against the tuberosity of the ischium, and the great toe, as in the case just related, was close to the anus." (p. 117.)

(a) St. Thomas's Hospital Reports. (b) Medical Gazette, vol. xiv. 1833, 34

Coulson observes that, in this affection, "the affected limb is liable to remarkable alternations of heat and cold; at one part of the day the limb feels cold, and assumes a purple aspect; at another, hot flushes, followed by perspiration, break out over the extremity; again, the limb does not merely feel hot to the patient, but is actually so to the touch of another, and the whole capillaries of the affected part become turgid with excess of blood." (p. 117.)

Goodlad (a) objects to the term hysterical being applied to these affections, and says: "If after a careful examination of the hip, or of any other joint, and of the muscles connected with it, no adequate cause of pain can be discovered there, it surely becomes an imperative duty, and it is the only one remaining to ascertain whether any and what cause exists in the course of the nerves, and if there be no such cause discoverable, the practitioner may safely rely upon finding it where it very frequently, nay, by much the most frequently exists, viz., at the point of connexion which those nerves possess with larger masses of the nervous system; it matters not whether in the brain or in the spinal marrow, the same effects follow. The tenderness of the skin both here and on the spine may alike be disregarded; it is sometimes permanent, at others fugitive; but in either case it is an indication only where disorder may be found by tracing the nerves distributed on these parts to their origin." (p. 93.)

In these cases menstruation is generally either irregular or defective, and the bowels are torpid; the most important point, therefore, towards the cure consists in putting these matters to rights by constitutional remedies. Local applications, I do not think, are of much service; but Brodie says:—"The parts may be bathed with a cold evaporating lotion, or they may be enveloped in a plaster composed of equal parts of the extract of belladonna and soap plaster, an application which will be found of singular utility, not only in these, but in a great number of other painful nervous affections." (p. 340.) Goodlad thinks that, in addition to whatever may be deemed necessary for the general state of the system, local measures must be had recourse to, *not* applied to the *part where* the pain is experienced, but to the origin of the nerves distributed to it; and the greatest caution seems necessary that nothing applied there can give local activity to vessels already too active.—J. F. S.]

225. As we shall now consider these diseased conditions of the various joints, under the several names already mentioned, (*par.* 198,) we shall be able to show, by the difference of their course and the result of pathological anatomy, in what structure the disease has primarily developed itself. Thus, the various opinions which have been advanced with great partiality, as to the nature of these diseases, will be known to be well founded in particular instances, although their universal correctness is denied.

I.—IN THE HIP-JOINT.

(Coxalgia, Morbus Coxarum, Luxatio spontanea Femoris, Coxarthrocace.)

226. The symptoms of this disease exhibit three very well-defined stages, according as the inflammation has an *acute* or *chronic* character.

(a) A letter to Sir B. Brodie, containing a Critical Inquiry into his Lectures illustrative of certain local Nervous Affections. London. 8vo.

227. In the *Acute Inflammation* of the Hip-Joint, after any occasional cause, there arises sharp pain in the hip-joint, which extends on the inside of the thigh to the knee-joint, not increased by touching the knee if the thigh be undisturbed at the hip-joint, but increased by any pressure and motion of the hip-joint itself. The region of the hip, especially the buttock, is more or less swollen, consequently its wrinkles are mostly somewhat deeper; the thigh is drawn up towards the belly, because outstretching it is very painful; the foot is turned somewhat outwards, and cannot be moved inwards without pain. If the length of both extremities be compared, they are either *alike* or the diseased extremity is *seemingly shortened* or *seemingly lengthened;* both, however, only in a slight degree. Fever exists in proportion to the severity of the symptoms. Standing and walking are very difficult, or even quite impossible; the patient, therefore, throws the whole weight of the body upon the sound limb, draws up considerably the hip of the ailing side, bends the knee, and merely touches the ground with the tip of his foot.

[Key (*a*) says:—"The hip-joint is less frequently the subject of acute than of chronic inflammation, probably from being well protected from the influence of atmospheric changes, to which the knee and most other joints are exposed. In the adult, acute disease of this joint is occasionally seen, in which the whole structure of the joint, cartilage as well as ligament, undergoes complete disorganization in the space of a few weeks." (p. 230.)]

228. If the inflammation do not subside, it passes into suppuration, with an increase of all the general and local symptoms; collections of pus are formed within the joint as well as on its exterior; the fever assumes a hectic character, the powers sink, the patient wastes considerably, the muscles of the hip and thigh become flabby, and a careful measurement of both extremities shows that the diseased one is really lengthened. The abscesses become superficial around the joint, either in its immediate neighbourhood or at a distance from it; and, during this time or subsequently, when the abscesses have burst, the head of the thigh-bone escapes from the hip-socket, and is dislocated commonly upon the back of the hip-bone (*b*), so that the diseased extremity becomes considerably shortened, is rolled inwards, and appears somewhat bent at the knee-joint. The patient now either sinks under long continued hectic consumption, or, what is more rarely the case, the suppuration diminishes, portions of bone come away, and the apertures of the abscesses close.

229. In the *Chronic Progress of Inflammation* of the hip-joint, the three stages are, on account of the gradual development of the symptoms, more distinctly and determinately marked (1). In the beginning, the patient complains of slight pain in the hip-joint, of some weariness in the thigh and stiffness of the joint, especially in the morning, which subsides during the day, but is always increased by much exertion. The pain is not continuous; it often increases towards evening, with slight febrile excitement, and specially resembles rheumatic pain moving slowly about the thigh (2). At the hip-joint itself no disease is discoverable, except an increase of pain on pressure behind the great trochanter, or on the front of the joint where the femoral vessels pass beneath Poupart's ligament. These symptoms

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(*a*) Med.-Chir. Trans., vol. xviii.

(*b*) I have presumed to use the ordinary English terms, hip-bone, haunch-bone, share-bone, and hip-socket, in preference to the Latin names, *ilium*, *ischium*, *pubes*, and *acetabulum*, and I purpose always employing English names wherever parts of the body possess them. I know no reason why we should be more ashamed of using our mother tongue than the Germans or the French, and I see no particular advantage in using the figurative Latin of the Schools.—J. F. S.

may continue, better or worse, for months or years, under a lingering course of this disease. The gait is merely trailing, and the foot commonly somewhat turned outwards.

[(1) **Brodie** says:—"I believe in the greater number of those cases to which the name of Diseased Hip has been usually applied, the ulceration of the cartilages is the primary affection, and the other parts in and near the joint become affected only in a secondary manner." (p. 137.) **Key** (*a*), however, holds a different opinion, and observes:—"The Hip Disease, emphatically so called, is a chronic affection, uniformly attended with ulceration of the cartilage;" and, from the cases which he has examined, he is induced to believe "that the ulceration is preceded by inflammation of the *ligamentum teres*." (p. 230.)

(2) It is somewhat remarkable that **Chelius** does not enumerate, among the symptoms of the first stage of hip-disease, the pain more particularly about the inside of the knee, which almost invariably exists, and being often the only pain noticed by the patient, has frequently led to mistake of the actual seat of the disease, and to the treatment of the knee as if that were the part affected. It indeed presents an example of **John Hunter's** (*b*) "remote sympathy," in which "there appears no visible connexion of parts that can account for such effects. In these cases there is commonly a sensation in the sympathizer which appears to be delusive, and produces a wrong reference of the mind to the seat of the disease." (p. 7.) This sympathetic pain in the knee is by some held to depend on irritation of the anterior crural plexus of nerves as it passes over the hip-joint; but Sir **Charles Bell** thinks the obturator nerve is the communicant. "The obturator nerve," he says (*c*), "passes through the thyroid foramen, down to the hip-joint, and, after supplying the muscles, is distributed upon the inner part of the knee. The nerve in its course is thus involved in the inflammation which affects the hip-joint, and the pain is referred to its extreme cutaneous branches, at a part distant from the seat of the disease." (p. 77.) **Coulson** does not agree with this explanation, as "very commonly we find the pain extending along the middle, and even outer part of the thigh, whilst the obturator nerve is distributed to the muscles of the inner side of the limb." He therefore suggests, that "from the intimate connexion of the long head of the *m. rectus femoris* with the outer edge of the acetabulum and with the capsular ligaments, the fascia of this muscle may take on the inflammatory action, and the pain in this way be conveyed down the limb to the thigh." (p. 3.) I prefer **Bell's** explanation, however; as certainly in the majority of the cases of diseased hip which I have seen, the pain is usually on the inside of the knee.—J. F. S.]

230. The second stage is characterized by a lengthening of the diseased extremity; the buttock of the affected side is flatter, its fold becomes deeper, the whole thigh is wasted and flabby, the great trochanter stands more upwards and outwards; every movement by which the surfaces of the joint are brought into contact is in the highest degree painful; the gait of the patient is very limping; the weight of the body rests entirely on the outstretched sound leg; the lengthened limb is bent at the knee, approached to the sound one, and the foot most commonly much everted. A peculiar sharp pain now comes on in the knee, which, however, usually retains its natural condition, only now and then being changed in its form, according to the observations of **Albers** and **Rust**. Although the pain in the knee is nearly always more severe than that in the hip-joint, yet the latter only is increased by direct pressure.

[**Astley Cooper** observes:—"The motions of the joint are impeded; extension is performed with difficulty; the child's knee is bent; and the heel, on the diseased side, scarcely touches the ground. Besides this incapacity for extension, great difficulty is experienced in the flexion of the joint. Thus if you attempt to bend the knee towards the abdomen, the child shrinks from the touch and complains of pain. If you throw something on the floor, and desire the child to pick it up, you will observe, that, in attempting to get possession of it, it bends only the sound knee. If you say, 'Let me see you put your foot on the chair,' the child does this readily enough with the sound leg, but is incapable of doing it with the other, in consequence of the confined state of the flexions of the joint. The rotation of the joint is also impeded, more especially the rotation inwards, which cannot be attempted without great pain and uneasiness. If the

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(*a*) Med. Chir. Trans., vol. xviii. (*b*) On the Blood, &c. (*c*) London Medical Gazette, vol. i.

patient be laid down on his face, to examine whether the nates are lower on one side than the other; there is generally a difference of an inch or more on the diseased side." (pp. 454, 55.)

As to the mode of determining the special part of the joint which is diseased, Key (*a*) observes "the motions of the joint, that give the patient most pain, are strongly indicative of the seat of the affection. In the earliest stage, before the soft parts could well be affected, if the disease commenced in the cartilage, eversion of the thigh and abduction of the limb from the other produce the greatest degree of suffering to the patient, while he can bear the joint to be flexed, and to be slightly inverted, without complaining. A similar indication of the *ligamentum teres* being inflamed, is the pain sometimes expressed on pressing the head of the femur against the acetabulum; in its healthy state the ligament being lodged in the hollow of the acetabulum, receives but little pressure, but when it is swelled by inflammation, the cavity of the joint affords it less protection; and, when pressure is made by forcing the head of the femur upwards, the ligament is compressed, and usually produces some degree of pain. The circumstance, too, of the *ligamentum teres* being destroyed by ulceration, when the head of the bone and acetabulum are only partially ulcerated, may be considered as presumptive proof of it being very early engaged in the disease. There are few cases of *post-mortem* inspection of the hip-joint in an advanced stage of disease in which the *ligamentum teres* is not found destroyed." (pp. 232, 33)]

231. The disease gradually runs on to its third stage; the diseased extremity becomes shortened, either as a consequence of displacement of the head of the thigh-bone, or, if that and the hip-socket have been destroyed by caries, by the diminished head of the bone being drawn into the much expanded socket. Oftentimes the disease here terminates, the pain diminishes, and on the spot where the displaced head of the thigh-bone lies a hollow is formed, or the head of the bone being retracted into the socket is anchylosed to it, and the patient consequently recovers with an incurable lameness. Most frequently, however, in this stage a painful fluctuating swelling occurs about the whole hip-joint, which ultimately breaks, and a quantity of pus is discharged; the suppuration becomes bad; the probe introduced into the abscess openings indicates carious destruction, and the powers of the patient are worn out by hectic fever. But rarely do these apertures close; the suppuration then diminishes, pieces of bone are thrown off, &c. &c.

In order to measure accurately the length of the extremity during the progress of this disease, we examine it most satisfactorily, according to Fricke's method (*b*), in the following manner:—The patient being laid on a table covered with a woollen rug, an assistant fixes the pelvis, and places his thumb beneath the anterior superior iliac spine, for the purpose of steadying the skin. A painted tape, or a wooden measure furnished with two moveable pointed transverse pieces, and a Paris measuring-scale, is now to be applied above the thumb of the assistant upon the spine, and being there fixed the other part of the measuring instrument is to be carried down to, and immediately beneath, the outer ankle. The same measurement is repeated on the sound side. In the same manner then is the thigh measured, the measure being stretched to the upper end of the splint-bone; and then the leg alone, which is especially necessary if the patient be unable to straighten the leg.

[Abscesses of the hip-joint do not always burst externally. "Sometimes the abscess," says Astley Cooper (*c*), "breaks into the pelvis, at other times into the rectum, and a large quantity of pus is voided with the stools, which was the case with a young gentleman I attended; in another case it opened into the vagina; the lady was lame, but ultimately recovered." We have also a preparation at St. Thomas's museum, of which, however, I do not know the history, excepting that Astley Cooper used to mention it as a case in which abscess of the hip-joint, in making its escape, had ulcerated a small hole in the femoral artery, as that vessel passed over the front of the joint. Besides these, Coulson mentions a case in which matter had made its escape from the affected joint into the pelvis, so as to press on the neck of the bladder, and had caused

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(*a*) Med.-Chir. Trans., vol. xviii.

(*b*) Ueber Coxalgie und Coxarthrocace; in Annalen der chirurg. Abtheilung des allgemeinen Krankenhauses zu Hamburgh, vol. ii. p. 21.

(*c*) MSS. Lectures on Surgery.

paralysis of that organ. (I presume he means retention of urine.—J. F. S.) On examination after death, I discovered," says he, "that the matter had escaped through the acetabulum to the posterior part of the bladder, and had made a lodgment close to its neck." (p. 23.) **Samuel Cooper** quotes a case under Dr. **Mackenzie**, of Glasgow, of a lad of sixteen, who died of enormously enlarged liver; but, on dissection, a communication was found through the bottom of the acetabulum, between the cavity of the hip-joint and the colon, smooth, as if of long standing. (p. 869) **Scott** also mentions a case of this disease affecting both hips, and the abscesses communicated with the cavity of the pelvis on each side, through the acetabulum. (p. 106.)"

So great is the importance of Diseases of the Hip-Joint, that I think it advantageous to give at length **Brodie**'s account

Of the difference between the Hip-disease arising from Ulceration of the Cartilage, and that from Scrofulous deposit in the cancellous structures of the Bones.

As already stated, **Brodie** considers that ulceration of the cartilages is the primary affection in the disease to which the term Diseased Hip is usually applied, and that the scrofulous affection of the cancellous structure is less common in the hip and shoulder than in many other joints, and that these two diseases have many circumstances in common, but have certain points of difference which, in their early stages, admit of their being distinguished from each other by careful and minute observation, it will be advisable to give his account of the symptoms presented by each.

The occurrence of ulceration of the cartilages at any period of life, though most frequently between the age of puberty and thirty-five years, has been already noticed, (p. 236,) as has that of scrofulous affection occurring frequently in children, though rarely after thirty years of age. (p. 238.)

"When the cartilages of the hip are ulcerated, the only symptoms met with for some time are pain, and a slight degree of lameness in the lower limb. The pain at first is trifling and only occasional; afterwards becoming severe and constant. It resembles a good deal the pain of rheumatism, since it often has no certain seat, but is referred to different parts of the limb in different individuals, and even in the same individual, at different periods. As the disease advances the pain becomes exceedingly severe, particularly at night, when the patient is continually roused from his sleep by painful startings of the limb. Sometimes he experiences some degree of relief from pain in a particular position of the joint, and in no other. A patient in St. George's Hospital never obtained any rest except when he had placed himself on the edge of the bedstead, with his feet on the ground and resting on a pillow. As the pain increases in intensity, it is more confined in its situation. In the greater number of instances it is referred to the hip and knee also, and the pain in the knee is generally the most severe of the two. At other times there is pain in the knee and none in the hip. Sometimes there is pain referred to the inside of the thigh, sometimes even to the foot. Wherever the pain is situated it is aggravated by the motion of the joint; but it is aggravated in a still greater degree by whatever occasions pressure of the ulcerated cartilaginous surfaces against each other. Hence the patient is unable to support the weight of the body on the affected limb; and if he be placed on an even surface, in a horizontal position, and the hand of the surgeon applied to the heel, so as as to press the head of the femur against the concavity of the acetabulum, violent pain is the consequence, although this be done in so careful a manner that not the smallest degree of motion is given to the hip-joint. This circumstance is well deserving of attention; and no one should attempt to give an opinion as to the nature of a disease connected with the hip, without having made an examination in the manner which has been just described. Soon after the commencement of the complaint the hip-joint is found to be tender, whenever pressure is made on it either before or behind. The absorbent glands in the groin become enlarged, and sometimes suppurate. Occasionally there is a slight degree of general tumefaction in the groin. In this there is nothing remarkable, since we must suppose that a disease going on within the articulation must ultimately occasion inflammation in the neighbouring parts. But it is a curious circumstance, that in some cases there is tenderness of those parts, to which, though not diseased themselves, the pain is referred from sympathy with the disease in the hip. I have observed this in the knee several times, and I have also seen a slight degree of puffy swelling of this joint, where pain was referred to it in consequence of disease in the hip. * * * When the disease has existed for some time the nates undergo a remarkable alteration in their form. They become wasted and less prominent, so that, instead of their usual convexity, they present the appearance of a flattened surface; they are flaccid to the touch, and hang more loosely towards the lower edge, and they have the appearance of being wider than those of the other side. In a very few cases, in the advanced stage of the disease, the nates are really wider, in consequence of the acetabulum being filled with coagulable lymph and matter, and the head of the femur being pushed out of its natural situation. But in general the increased breadth of the nates is only apparent, and on an accurate measurement no difference will be found between the nates on one side and those of the other. The alteration in the figure of the parts, in those cases may arise partly from the position in which the patient usually places himself when he stands erect; but the principal cause to which it is to be attributed, is the wasting of the large fleshy bellies of the glutæi muscles, from want of use; and this has been ascertained by repeated and accurate examinations of the living, and numerous dissections of the dead body." (p. 153–57.)

"While the disease is going on in the cancellous structure of the bone, before it has extended to the other textures, and while there is still no evident swelling, the patient experiences some degree of pain, which, however, is never so severe as to occasion serious distress, and often is so slight, and takes place so gradually, that it is scarcely noticed. After a time (which may vary from a few weeks to several months) the parts external to the joint begin to sympathise with those within it, and, serum and coagulable lymph being effused into the cellular membrane, the joint appears swollen. The swelling is puffy and elastic, and though usually more in degree than it is, at the same period, in those cases in which the ulceration of the cartilages occurs as a primary disease, it is not greater in appearance, because the muscles of the limb are not equally wasted from want of exercise. I have observed that in children the swelling is, in the first instance, usually less diffused and somewhat firmer to the touch than in the adult. If a suspicion of some disease of the joint has not existed previously, it is always awakened as soon as the swelling has taken place. Should the patient be a child, it not uncommonly happens that the swelling is the first thing which the nurse or the parents discover. This leads to a more accurate inquiry, and the child is observed to limp in walking, if the disease be in the lower limb, and to complain of pain on certain occasions. * * * The swelling increases, but not uniformly, and it is greater after the limb has been much exercised than when it has been allowed to remain for some time in a state of quietude. As the cartilages continue to ulcerate the pain becomes somewhat, but not materially, aggravated. It is not severe until abscess has formed, and the parts over the abscess have become distended and inflamed. The skin, under these circumstances, assumes a dark-red or purple colour. The abscess is slow in its progress; when it bursts, or is opened, it discharges a thin pus, with portions of curdly substance floating in it. Afterwards the discharge becomes smaller in quantity, and thicker in consistence; and, at last, it nearly resembles the cheesy matter which is found in scrofulous absorbent glands. In most instances several abscesses take place in succession, but at various intervals; some of which heal, while others remain open, in the form of fistulous sinuses, at the bottom of which carious bone may be distinguished by means of a probe. (p. 250–53.)

The progress of the malady in both these forms of hip-disease are very nearly alike; in both is there the same reference of the pain to the knee rather than to the joint affected, the same alteration in the appearance of the nates, the same shortening of the limb from destruction of the head of the thigh-bone, or its dislocation, and the same production of abscesses. But the principal distinction is in the less degree of pain which accompanies the scrofulous disease, "except in a very few instances, and in the most advanced stage of the disease, when a portion of the ulcerated bone has died, and having exfoliated, so as to be loose in the cavity of the joint, irritates the parts with which it is in contact, and thus becomes a source of constant torment." (p. 256.)]

232. Among the phenomena which appear in the course of the coxalgia, the *shortening* and *lengthening* of the diseased limb have specially attracted the attention of physicians, and have given rise to various explanations, which must be particularly considered.

["In most cases of lameness or wasting of the lower extremities, the affected limb," says John Hunter (*a*), "appears longer than the other, in consequence of the patient pressing most on the sound limb, and putting the diseased one further out from the pelvis so as to raise the ilium. This is particularly the case in diseases of the hip, although the leg is not found to be longer than the other, if the patient is laid on the back. It arises from the centre of motion in the pelvis being rather altered by habit, which is removed if the patient is laid on the back. But sometimes, when the muscles are much wasted, the limb is shorter, which I cannot account for, nor why the limb is

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(*a*) Lectures, Palmer's Edition.

sometimes drawn up more, and sometimes put out further than the other. Mr. Cline says the limb is actually longer and shorter in different stages of the disease, and accounts for it thus:—In the first instance, inflammation takes place in the ligaments of the joints, occasioning the parts to swell, and a larger quantity of synovia to be accumulated in the joint, which displaces and pushes out the head of the femur, thus occasioning a lengthening of the limb; but as the disease advances absorption takes place, not only of the accumulated synovia, but also of the bone itself, with the surrounding ligaments; and the head of the bone being drawn into the new-enlarged cavity by the action of the gluteal and other muscles, occasions a shortening of the limb; and this lengthening and shortening of the limb is peculiarly evident on laying the patient on the belly." (p. 595.)

"In order to form a correct judgment" upon the actual state of the limb, Lawrence (*a*) says, "you must strip the patient, and make the examination on a straight horizontal surface. You will then immediately observe the position of the pelvis and discover the cause of the apparent elongation or shortening of the affected limb. At all events, you may remove every doubt as to the apparent or manifest shortening or elongation, by measuring on each side from the anterior superior spine of the ilium to the patella; this will enable you to ascertain whether there is a real, or only a seeming alteration in the length. The change, however, in the subsequent period of the affection is quite a different matter. The disease, as it proceeds, is attended with destruction of the *ligamentum teres*, with ulcerative destruction of the orbicular ligament of the hip-joint, with destruction and ulceration of the head of the thigh-bone, and of parts of the acetabulum. Thus all the causes which would prevent the muscles from retracting the limb are removed; the muscles, therefore, draw the extremity upwards and outwards, and a real shortening to the extent of some inches, is the consequence." (p. 485.)]

233. The *shortening* of the extremity which, commonly, occurs in the first period of acute inflammation of the hip-joint, is always *a seeming shortening dependent on a shifting upwards of the pelvis on the diseased side.* All other explanations given of this shortening are incorrect, and incompatible with the true situation of the hip-joint; such as Rust's, and specially Fricke's, explanation, that, by violent muscular contraction, which occurs in this acute inflammation of the joint, the head is pressed deeper into the socket, and thereby the shortening of the limb is produced.

Fricke (*b*) seeks to ground his opinion on the circumstance, that the leg in its healthy condition may be shortened by voluntary effort of the muscles of the thigh, —as every one may prove on himself. But this assumption is quite incorrect, and whoever makes the experiment on himself or on some other person, will, if, at the same moment when the thigh is retracted, the hands are placed on both hip-bones, easily and decidedly be convinced that the retraction of the extremity depends only on the elevation of the hip-bone. It is perfectly inadmissible to explain the shortening by the compressibility of the cartilaginous overspreading of the head of the thigh-bone and its socket. In the severe painfulness of the acute inflammation of the hip-joint, the thigh is always more or less bent and drawn up towards the belly; the muscles are no doubt contracted, but at the same time the patient draws up the pelvis, especially if, as usual, he lies bent towards the sound side, and the extent of this drawing up of the pelvis is in close dependence upon the degree of painfulness and upon the position which the patient constantly assumes. We therefore observe the same in bruises of the parts about the hip-joint, and in every painful affection of the thigh and hip. An unprejudiced observation and attentive measuring, will convince every one of the truth of the statement here advanced. I have observed two cases of traumatic inflammation of the hip-joint, in which this *seeming* shortening of the extremity had led the medical attendants into the belief of a luxation, and to the employment of very improper means for its reduction.

234. The *lengthening* of the extremity which occurs in chronic, and in the latter course of the acute coxalgia, when morbid changes have been set up in the joint, may be either *seeming* or *real.* The seeming lengthening is here again dependent on the shifting of the pelvis, because the patient in the tedious course of this disease still limps about, and in doing so throws the weight of the whole body upon the sound extremity, and, by this means

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(*a*) Lectures in Lancet.

(*b*) Above cited.

and by the position he keeps in bed, the pelvis is so twisted that the hip-bone on the sound side is raised, and that on the diseased side depressed. In the subsequent course of the coxalgy, when the morbid changes in the joint have proceeded still further, there is *real lengthening* of the diseased extremity, which does not depend on mechanical disproportion between the head of the thigh-bone and its socket, and the expulsion of the head of the bone on account of its increased bulk, but *upon the extension of the capsular ligament, on the collection of fluid, on the relaxation of the capsular ligament, and on flaccidity of the muscles.*

The most different reasons have been assigned for the lengthening of the extremity consequent on the supposed expulsion of the head of the thigh-bone from its socket; for instance, accumulation of synovia (Petit, Camper, and others;) swelling and degeneration of the mass of fat, improperly called the synovial gland, in the hip-socket. (Valsalva, Monro, van der Haar, de Haen, Vermandois, Schwencke, Callisen, Plenck, Portal, Ficker, &c.;) inflammation and swelling of the joint-capsule (Duverney, Closeius;) swelling of the cartilage, round ligament, and mass of fat (Boyer;) swelling of the cartilage and periosteum of the head of the thigh-bone and its socket (Falconer;) swelling of the head of the bone from *caries centralis* (Rust;) destruction of the lower edge of the hip-socket (Langenbeck;—in destruction of the upper edge shortening is said to occur;) relaxation and unnatural extension of the ligaments and muscles (Richter, Schreger, Larrey, Chelius;) relaxation of the muscles (Fricke.) Brodie first accurately explained the *seeming* lengthening of the limb as dependent on the twisting of the pelvis, produced by the position of the patient, and connected with a lateral twisting of the vertebral column. This opinion, however, was not particularly regarded, and considered to have been only incidentally noticed in single cases (Falconer, Crowther, Rust;) while, on the other hand, the explanation given by Rust of the enlargement of the head of the bone by *caries centralis* was most commonly received, which opinion, however, is groundless, and was formerly disproved by me by the results of morbid anatomy, and more recently by Fricke's (*a*) experiments on the dead body.

Weber's interesting experiments show that the head of the thigh-bone is chiefly retained in its socket *by atmospheric pressure;* since, if all the muscles and ligaments surrounding the hip-joint and even the capsular ligament itself be cut through, the head of the bone is not withdrawn from its socket by the weight of the depending extremity; whilst, with perfect integrity of the ligaments and muscles, the head of the bone drops from three to four lines out of the socket so soon as, by boring through the latter from the pelvis, the atmospheric pressure is permitted to operate on the surface of the head of the bone (*b*). These experiments are of great importance in reference to diseases of the hip-joint, as Gædechens has shown in a very perspicuous manner (*c*). Hence it is most completely proved that, as we have already observed, a shortening of the extremity from violent pressing of the head of the bone into its socket is perfectly inadmissible; and, on the other hand, that by mere relaxation of the muscles (as Fricke supposes) no lengthening of the extremity can be produced: since neither, as already mentioned, does there exist any space between the socket and the head of the thigh-bone which can be changed by any muscular action, or can be increased by their relaxation, as the most perfect and intimate contact exists. It further follows that, when an actual lengthening of the extremity takes place, the stated relations between the head of the thigh-bone and its socket must have been first destroyed by diseased changes, and the ground of the actual lengthening we can only *seek in the simultaneous relaxation and distension of the capsular ligament by increase of its fluid contents, and in the relaxation of the muscles.*

Fricke's observation, that in the *seeming* lengthening of the extremity, (by dropping of the pelvis,) measurement shows the shortening of the thigh to be, as Gædechens correctly observes, and as every one can prove to himself by voluntary dropping of one or other side of the pelvis, and placing one finger on the crest of the hip-bone and another on the great trochanter, dependent on the whole hip-bone of the sunken side being approached nearer to the great trochanter, whilst on the opposite side the hip-bone is proportionally separated from the trochanter; in consequence of which, in the one instance a shortening, and in the other a lengthening, of the space between the great trochanter and the iliac spine, and consequently of the whole bone, must be produced.

(*a*) Above cited.

(*b*) Müller's Archiv. für Anatomie, 1836, part i. p. 54; Müller's Handbuch der Physiologie, vol. ii. p. 124; Lauer in Hamburger Zeitschrift für die ges. Med., vol. ii. part iii. p. 283.

(*c*) Die Physiologie des Hüftgelenkes in ihrer Beziehung zur Lehre von den Coxarthrocace; in Hamburger Zeitschr., vol. vi. part i.

[As regards the lengthening of the limb Astley Cooper says:—"It is possible that an effusion into the joint may push the limb a little, but I doubt whether this has any influence in producing an elongated appearance of the limb. The length of the limb is not really increased, but an appearance of elongation is produced by the parietes being depressed on the diseased side." (p. 454.)

Lawrence gives a very good description of the lengthening of the limb. He says:—"In the earlier period of the disease we sometimes find the limb longer than that on the sound side, and sometimes shorter. This is only apparent. It depends on the position of the pelvis; hence, when the lower extremity of the affected side appears to be longer than that of the other, we shall find that the anterior superior spine of the ilium on that side is so much lower than its fellow; if the extremity of the sound side appear to be the longest, we shall find that the anterior superior spine of the ilium of that side is lower down than that of the affected side. When a patient has this disease of the hip-joint, the weight of the body is not supported on both hips, but by that of the sound side; so that when the patient stands erect, the sound thigh sustains the weight of the trunk, and the diseased lower extremity is placed in front of the sound leg, the knee being a little bent, and the anterior part only of the foot brought to the ground. Under these circumstances, the pelvis, generally speaking, sinks a little towards the diseased limb, and this is compensated by the limb being bent a little towards the opposite side; a degree of curvature of the spine is thus not unusual in affections of the hip-joint. In other instances, however, the patient bends the knee slightly on the affected side, and rests the foot on the ground; this will be attended with an apparent shortening of the extremity. In order, then, to form a correct judgment, you must strip the patient, and make the examination on a straight horizontal surface. You will then immediately observe the position of the pelvis, and discover the cause of the apparent elongation or shortening of the affected limb." (pp. 484, 85.)]

235. Dislocation of the head of the thigh-bone is not a necessary phenomenon in the third stage of coxalgy, it is rather accidental, and depends on the position of the diseased extremity, on the motions of the patient, and other influences during the relaxation of the muscles, and on the relaxation and destruction of the ligaments, specially of the round ligament. Hence the dislocation may occur in various directions; most commonly, indeed, backwards and upwards; but also downwards and inwards, (Nester, Van der Haar, Berdot, Schreger, Textor,) in which case the direction and length of the extremity are differently circumstanced. In rare cases the head of the bone superficially destroyed by caries may remain, and become anchylosed with the socket, which has also been deprived of its cartilaginous overspreading by similar caries; of this termination of coxalgy I have two specimens. Spontaneous separation, and throwing off of the head of the bone through the enlarged apertures of the abscess, may also ensue (*a*).

[Coulson quotes from Hoffman two cases in which the detached head of the femur made its way through the abscess and was removed by the assistance of the surgeon. (p. 23.)

If the patient's constitution be sufficiently strong to carry him through the stages of this disease which have been mentioned, the hip-joint will be found on examination after death, in one of three or four different conditions; two of these I have already noticed, viz., the overspreading of the head of the thigh-bone and its socket with an ivory-like deposit, and anchylosis of the ball and socket, almost invariably by bone. But sometimes the capsular ligament having given way the head of the thigh-bone slips through and is dislocated, and the most common direction it takes is upwards on the back of the hip-bone (*dorsum ilii.*) But it may be displaced, though more rarely, into either of the other localities of dislocation; thus the younger Earle (*b*) mentions a dislocation into the ischiatic notch; in the Museum of the Royal College of Surgeons of England there is a dislocation into the *foramen ovale;* Boyer also mentions a case of

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(*a*) Cases of this kind, in which the cure was always followed by the use of the joint, are to be found in Schlichting; in Philos. Trans. 1742: A. F Vogel, Obs. quæd. chirurg. Kiliæ, 1771, No. 2: Hofmann, vom Scharbrocke, Münster, 1782, § 283: Hedenus de Exstirpatione Femoris, p. 65: Klinge; in Jæger's Handwörterb. der Chir. u. Augenheilk, vol. i. p. 585.

this kind, **Brodie** another, and **Coulson** another in a boy nine years old, in which "the limb was much elongated, the knee and foot turned outwards, and the head of the femur near or in the *foramen ovale*," (p. 19); **Ducros** the younger (*a*) speaks of a dislocation forwards on the horizontal branch of the share-bone (*os pubis*) in a female twenty-seven years old, who had inflammation of the hip-joint.

When dislocation has taken place the new socket is formed on that part of the pelvis on which the head of the thigh-bone rests, and according as the head is nearer or farther from the hip-socket, does the latter participate in the formation of the new joint, the unoccupied part of the socket being filled up with a structure which in one case **Samuel Cooper** (*b*) describes as consisting "partly of a fungoid (granulating, I presume, J. F. S.) mass, and partly of firm coagulating lymph. The brim of the acetabulum was rough and gritty, and the os ilium above the acetabulum destitute of periosteum." (p. 255.) The same writer also mentions a most remarkable instance which is in University College (London) museum, in which "the articular cavity is formed in the upper portion of the femur and a new ball on the ilium. The old acetabulum is nearly obliterated, and near it within the pelvis the remains of the cyst of an abscess." (p. 868.)

At other times, however, no dislocation takes place, but the hip-socket expands, perhaps in part from the pressure of the pus contained in the capsular ligament or within the walls of the abscess which form about it, and in part from the continual pressure of the head of the thigh-bone against the edge of the socket, softened by its spongy tissue, which has lost its cartilaginous and bony articular covering, soaking constantly in pus, in consequence of which the socket loses its deep cuplike shape, and often resembles a shallow saucer with a much-everted lip. Upon this the wasted head of the bone moves, and were it not for the adhesive deposit which has taken place in the surrounding soft parts and rendered them unyielding, so that they really act as a mould to keep the parts of the joint together, the thigh would dangle, and never permit the weight of the body to be borne on it, which is contrary to what frequently happens.—J. F. S.]

236. Characteristic, however, as are the phenomena of coxalgy, yet may they be confounded with other diseases; for instance, with the congenital luxation of the thigh, with a shortening of the extremity from a recession and twisting of the hip-bone, nervous sciatica. and *malum coxæ senile.*

In Congenital Lameness, the cause of which lies in dislocation of the hip-joint, the thigh is shortened from the very beginning: if, whilst the child lies in the horizontal position, the pelvis be fixed with the hand by slight drawing down, the thigh can be, without pain, somewhat lengthened, but again shortens when the extension is withheld. The buttock is either natural or flatter, the motion of the thigh is free, and the sole of the foot can be placed completely on the ground. If the congenital dislocation exist, as it usually does, on both sides at once, the diagnosis is thereby assisted; but, if it exist only on one side, a mistake in the diagnosis can only arise from superficial examination. I have, however, seen two cases of congenital dislocation of the thigh on one side, which were really treated as coxalgy.

In Twisting of the Hip-bone, which depends on weakness and looseness of the ligaments, the patient suffers least pain in the morning but most in the evening, the one hip is higher than the other, the extremity is from the first shortened, and can be lengthened by a slight pull.

In Sciatica the pain follows the course of the ischiatic or crural nerves; there is a sense of lameness in the whole thigh; no change is observed in the position of the great trochanters or in the length of the two extremities (1).

In the *malum coxæ senile*, which depends on interstitial absorption and wasting of the head and neck of the thigh-bone, pain and stiffness first appear in the hip-joint; the former does not continue with equal severity, and the latter is diminished or lost in walking, but generally

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(*a*) Gazette des Hôpitaux, June 30, 1835. (*b*) Surgical Dictionary,—article, *Diseases of Joints.*

towards evening becomes worse, which is also invariably noticed in cold moist weather, and in oppressive heat. The extremity gradually begins to shorten; the patient begins to limp, but can set the sole of the foot flat upon the ground; the toes are turned outwards; the lumbar vertebræ acquire a great degree of mobility; the buttock on the affected side is less prominent; a careful measuring of the limb in the mode directed shows actual shortening. The patient frequently complains of pain in the region of the knee, which has its seat, however, rather in the knee-cap, and which he describes as if it were dependent on the contraction of the flexing muscles. I have never observed increase of pain in pressing on the hip-joint (2).

Coxalgy cannot be well confounded with white leg, *(phlegmasia alba dolens,)* with psoas abscess (3), nor with primitive dislocation of the thigh; but it may be confounded with fracture of the neck of the thigh-bone, if the shortening be slight, the patient still walking, the upper fractured portion thrust into the shaft of the lower, and if inflammatory symptoms have taken place (Jæger).

[(1) In regard to the pain in hip disease, Sir Charles Bell (*a*) observes, "that pain arising from disease of the great sciatic nerve, as it passes near the hip-joint, may be mistaken for inflammation of the hip involving the same nerve; so that when you find a patient with pain in the hip, the very first thing you have to inquire is, whether this be not symptomatic of internal disease? and I would remind you that it is not the more formidable disease of the viscera which produces this affection of the nerve, but rather disordered function. The next thing you have to consider is the lesser degree of pain in the hip, which still proceeds from disorder in the lower part of the canal; for example, accumulation in the colon will produce pain in the hip, which may be mistaken for disease in the hip-joint." (p. 297.) I remember a very good example of the pain produced as just mentioned by Bell, though the accumulation was very slight, but recurred continually a few hours after eating even a small quantity of hard biscuit, which, as soon as it reached the synovial flexure of the colon, produced a dull heavy pain in the iliac pit, and thence extending down the inner and fore part of the thigh to the knee increased on walking. This would continue, although the bowels acted freely and as usual, for two, three, or four days, till either castor oil were taken, or an injection thrown up for its special relief; soon after which all the pain ceased.—J.F.S.]

(2) This disease, my own personal observations of which entirely agree with those of Smith (*b*) and of Wernherr (*c*) cannot, if attention is paid to the symptoms above mentioned, be readily mistaken for coxalgy. I have, however, seen such mistake twice. The disease occurs generally in elderly persons, rarely before fifty years of age. I have most frequently seen it after concussion and contusion of the hip-joint, specially in women, but occurring, also, without any previous cause. In some cases the gout seemed to me connected with it. This disease never runs into suppuration, and, above all, excites no symptoms dangerous to life. On examination of such a joint, the capsular ligament is found thickened, the cotyloid ligament bony or absorbed, the round ligament destroyed, the mass of fat in the hip-socket wasted, the cartilage of the socket absorbed, and in its stead a hard enamel, and the hip-socket materially changed in form and extent. The cartilage on the head of the bone is absorbed, and the surface of the head is porous. I have, however, found, in advanced disease, the cartilage on the head of the bone unchanged. In cases of long continuance, a hard glossy enamel is generally deposited on the surface of the bone; the round shape of the head is changed, at first it is flattened from above downwards, but, subsequently, it assumes the shape of the socket.

The neck of the thigh-bone is subject to a partial or complete absorption, and the head sinks together with the shaft at a right angle, and appears to stand out directly from it. If the head and neck of the bone be sawn vertically, it has completely the appearance of a fracture of the neck of the thigh-bone, externally to the capsule, which has united; the bony mass is remarkably light, and the shaft of the thigh-bone consists merely of a thin bony shell, and the medullary canal is much widened. Astley Cooper and Charles Bell have made remarks on these changes of the head and neck of the thigh-bone; and Smith has also observed them in the shoulder-joint.

(*a*) Medical Gazette, 1838-39.

(*b*) Dublin Journal of Medical Science, vol. vi. Sept. 1834. (*c*) Schmidt's Jahrbucher.

[(3) **Coulson** says:—"The disease of the hip in this (third) stage may be mistaken for psoas abscess; attention, however, to the following points will materially assist us in our diagnosis. *First*, in psoas abscess, the patient complains of violent or dull pain in the region of the loins, which is very much increased in the upright posture of the body, and by every motion of the limb, particularly on extending it; in the diseased hip there is no fixed pain in the loins; it is felt more in the neighbourhood of the hip, and especially in the knee. *Secondly*, in psoas abscess, during the whole course of the complaint, there is no deviation to be perceived in the natural situation of the trochanter, and no difference in the length of both limbs; in diseased hip, on the contrary, this is always the case. *Thirdly*, in affection of the psoas muscle, the patient cannot turn the foot of the affected side outwards, without increasing the pain; in diseased hip, on the contrary, the foot is generally turned outwards. *Fourthly*, on taking a deep inspiration, on coughing or crying, and in the erect posture of the body, the fluctuating swelling, either on the nates, or in front of the thigh, increases, and the exit of matter, if the abscess burst or be opened, will be facilitated; in abscess of the hip-joint from disease, neither is the case. In this stage, also, the disease of the hip may be confounded with deep-seated formation of matter in the region of the groin, either connected or unconnected with a carious state of the bones of the pelvis. In these cases there is very acute pain in the anterior region of the hip, with shiverings, and inability to rest the limb on the ground, but the great diagnostic mark is the absence of pain on rotating the head of the femur. There is no pain over the posterior part of the joint, or at the knee." (pp. 34, 5.)]

237. Examination of the joint after death presents different results, according to the degree of the disease and its original seat. In the earlier stage, the cartilaginous covering of the head of the thigh-bone is mostly inflamed, ulcerated, often the spongy substance itself is inflamed and more rarely the synovial membrane, the capsular ligament is swollen, the round ligament still maintaining the connexion between the bone and its socket; at a later period of the disease the cartilaginous covering of both the head and socket is destroyed; the former is carious, often entirely separated from its neck; the carious destruction penetrates even into the cavity of the pelvis; the synovial membrane and capsular ligament are entirely changed, swelled up, and destroyed; pus is collected in the joint and between the muscles. If the head of the bone be displaced, the socket also is entirely filled with a steatomatous mass, or with brown pus.

[It has been already stated, that **Brodie** holds ulceration of the cartilages to be a primary form of disease of joints; his reasons for which opinion are quoted previously (p. 229); and his statement of the symptoms which peculiarly characterize it in the hip-joint are also subsequently mentioned. (p. 254.) **Key**, however, does not entirely, at least, agree with **Brodie** on this point, and the following are his views:—"The opportunities," says he, "which present themselves to any individual of observing this disease in its early stage by dissection, must necessarily be few. The cases which it has fallen to my lot to examine, have induced me to believe that the ulceration of the cartilage is preceded by inflammation of the *ligamentum teres*." He found in "a young female who, for six months prior to her death, had laboured under the usual symptoms of chronic inflammation of the hip-joint," and in whom "the symptoms had partially yielded to the treatment employed, when she was attacked by another disease, of which she died, the *ligamentum teres* much thicker and more pulpy than usual, from interstitial effusion, the vessels upon its investing synovial membrane distinct and large, without being filled with injection. At the root of the ligament, where it is attached to the head of the femur, a spot of ulceration in the cartilage was seen commencing, as in other joints, by an extension of the vessels, in form of a membrane, from the root of the vascular ligament. The same process was also taking place on the acetabulum, where the *ligamentum teres* is attached. I cannot undertake to say, that the hip-disease shall, in every instance, present these morbid appearances, or that cases do not occur in which ulceration exists as a primary disease, without any affection of the ligament or synovial membrane. Mr. **Brodie's** assertion, that it does exist as a primary disease, coming from so excellent a pathologist, is sufficient to substantiate the fact. But observation of this disease in its different stages, and of the mode in which the disease is brought into action, together with the *post-mortem* appearances, afford strong proof that, at least in many instances, the action is propagated from the ligament to the cartilage, and that ulceration of the latter is consequent upon inflammation of the former." (pp. 230, 31.)

In confirmation of KEY's opinion, I mention the following account of the examination of a hip-joint by my friend WILLIAM ADAMS, in a case with which I was most deeply and painfully interested. The child, ten years of age, had been lame in the right hip for five or six months, but had no other symptom of hip-disease, no pain on motion nor on pressure, nor any restriction to the motion of the limb, till within a fortnight of his death, (which was caused by tubercles and effusion into the ventricles of the brain,) when he complained of violent pain, if the thigh were only slightly moved in lifting him from or to the bed. A small abscess, of the size of a nut, was found close to the origin of the upper head of the *m. rectus femoris*. On laying open the capsular ligament, a small quantity of dirty brown-coloured fluid escaped. The synovial capsule had become thickened, tender, in the sense of being readily torn, granular on the surface, and yellowish in colour. The round ligament and contiguous synovial membrane in the portion of the acetabulum uncovered by cartilage had been the seat of inflammation, the vessels were injected, the membrane was thickened, and a small quantity of lymph adhered to its surface. The state of the synovial membrane of the round ligament, just described, appears to me precisely the same as that described in KEY's case, but less advanced.—J. F. S.]

238. The general observations already made apply to the etiology. Inflammation appears to arise in the hip-joint, more frequently in the cartilage and bone than in the soft parts.

FRICKE (*a*) makes a distinction between coxalgy and coxarthrocacy. In the former, at the onset, there is not, he says, any inflammatory affection in the hip-joint, but only relaxation of the muscles, whereby in time an inflammatory affection of the hip-joint is secondarily produced. The latter is always from the beginning connected with distinct inflammatory symptoms of the hip-joint. We cannot, however, agree to the admission of a coxalgy in this sense, after what has been said of the lengthening of the extremities, and after the results of our experience.

239. The prognosis is always unfavourable, least so, however, if disease have arisen in the ligaments, or in the synovial membrane. In the first period of the disease only is the cure of the disease possible; subsequently, even if healing should follow, there still remains a more or less halting gait. In actual dislocation, or in anchylosis, the lameness is very decided. It is generally less dangerous in children than in grown persons. In robust people, and where external violence has caused the disease, the prognosis is more favourable than in generally dyscratic subjects. If it have already proceeded to carious destruction, to the formation of abscess in the hip-joint, there is but rarely any cure possible.

240. The *treatment* of coxalgy is guided by the rules already laid down, and must vary according to the activity of the inflammation, the stage of the disease, and the general causes connected with it.

241. In the *first stage of acute coxalgy*, the *treatment* corresponding to it must be strictly antiphlogistic, and the diseased extremity kept in the most perfect quiet. In traumatic inflammation, if very severe and in robust persons, blood-letting, repeated application of a great number of leeches, and continued cold applications, with corresponding attention to food, and cooling medicine given internally are required. If the inflammation be less active, especially when it springs from rheumatic causes, or in scrofulous persons, repeated application of leeches or cupping will always be found sufficient. If the pain and inflammation diminish, which is shown by the natural direction and length of the limb being restored, rubbing in mercurial ointment and repeated blisters must be by turns employed around the whole joint. Care must be taken in warm bathing, which is recommended by many, as the motion connected with it, and the cold so easily taken after it, frequently operate prejudicially. If the inflammation continue for a

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(*a*) Above cited.

long time in a less degree, especially in strumous subjects, a continued and powerful derivation must be kept up by a pea-issue behind the great trochanter. If all pain cease, and the motions of the hip-joint become free, only gradual and careful use of the limb may be permitted, so that no cause may be given for a relapse, or a passage of the disease into the chronic form, which so easily happens in negligent and too early motion.

[With regard to salt-water bathing COULSON observes:—"In no class of patients, and in no stage of this particular disease, are sea air and warm salt-water bathing so beneficial as here. Warm or tepid bathing agrees with nearly every patient. * * * The sea-side, however, is not beneficial in cold weather. The best time is from the beginning of May to the end of October; but, if the autumn sets in cold earlier than usual, the patient should return before this. * * * The period at which patients affected with diseases of the hip-joint derive most benefit from going to the sea-side is, either at the commencement of the disease, before much inflammatory action has begun, or towards the end of the third stage, when the abscesses are discharging, and the health is impaired by the long continuance of the complaint. On the contrary, during the formation of matter, and before the abscess begins to discharge, the patient will not derive much benefit from the change. The plan adopted at the Margate Infirmary is as follows:—For the first two or three days after the patient's admission, warm bathing only is employed, in order that the constitution may recover the effect of the journey, and adapt itself to the atmospheric change. The patient commences with the warm salt-water bath about three times a-week, at a temperature of 96 degrees, and is directed to remain in it from fifteen to twenty minutes each time. Afterwards the tepid bath is used; and then, dependent on the state of the weather, and the health of the patient, the cold bath is employed; one dip only in the sea being allowed each time. The time selected for bathing is in the morning. The cold or warm douche bath is often used in this stage with very good effect." (p. 79–82.)]

242. If the coxalgy have from the beginning assumed a chronic course, the most perfect rest, which can be produced by securing the diseased limb in a suitable apparatus, is essential, and is often alone sufficient in slight form of the disease, to produce a cure, in a space of time varying from eight to ten weeks. According to the degree of pain in the hip-joint and the inflammatory symptoms, leeching or cupping, rubbing in mercurial ointment with caustic ammonia, repeated blisters, or an issue behind the great trochanter, are here especially indicated.

NICOLAI (*a*), KLEIN (*b*) and others have recommended, (and employed with advantage,) for keeping up the continued rest of the diseased limb, the apparatus for fractured neck of the thigh-bone. PHYSICK (*c*) has proposed a treatment of coxalgy, of which the fixing of the limb in apparatus is the principal part. If the joint be swollen and inflamed, he applies leeches; then gives his patient for some weeks a laxative of cream of tartar, and jalap every other day, so as to produce copious stools. During the employment of the purgatives, the patient must be kept lying horizontally in bed upon a horse-hair mattress, and not leave that posture till he is perfectly cured. When the patient, during the use of the purgatives, has become accustomed to lying, a padded splint, reaching from the middle of the chest to the outer ankle, fitting closely, and surrounding nearly half of the parts, is to be applied. If the leg be bent, the splint must be accommodated to the curve of the limb. When the patient has worn the angular splint for some time the limb may be brought to a straight position, and a straight splint applied. In most cases only two splints are necessary. The splint should be attached by one bandage around the breast, and by a second from the ankle to the hip. The shortest time for the cure is six months, the longest two years, and the middle and usual time a year. During this time the splint should be continually on the limb, and never removed till the symptoms of the disease are manifestly diminished; in which case the limb may be moved very gradually. This treatment is, however, admissible only when the head of the thigh-bone is neither destroyed by caries, nor has become displaced; when no abscess has yet formed, and the patient has not apparently a scrofulous constitution.

The following is the plan of treatment recommended by the SCOTTS (*d*), which is often very efficient, and may be employed on any joint.

(*a*) Journal von GRAEFE und WALTHER, vol. iii. part ii.

(*b*) Ib., vol. iv. p. 25.

(*c*) American Journal of Medical Science, Feb., 1831.

(*d*) Cited above.

"In the first place, the surface of the joint, suppose the knee, is to be carefully cleansed by a sponge, soft brown soap and warm water, and then thoroughly dried; next, this surface is to be rubbed by a sponge soaked in camphorated spirit of wine, and this is continued a minute or two, until it begins to feel warm, smarts somewhat, and looks red. It is now covered with a soft cerate made with equal parts of the *ceratum saponis* and the *unguentum hydrargyri fortius cum camphorâ.* This is thickly spread on large square pieces of lint, and applied entirely around the joint, extending for at least six inches above and below the point at which the condyles of the femur are opposed to the head of the tibia; over this, to the same extent, the limb is to be uniformly supported by strips of calico, spread with the *emplastrum plumbi* of the London Pharmacopœia. These strips are about an inch and a half broad, and vary in length; some are fifteen inches, others a foot, others half these two lengths, and the shorter or longer are selected according to the size of the part round which they are to be applied. This is the only difficult part of the process. This adhesive bandage ought to be so applied as to preclude the motion of the joint, prevent the feeble coats of the blood-vessels from being distended by the gravitation of their contents in the erect posture, and thereby promote their contraction. Over this adhesive bandage, thus applied, comes an additional covering of *emplastrum saponis*, spread on thick leather, and cut into four broad pieces, one for the front, the other for the back, the two others for the sides of the joint. Lastly, the whole is secured by means of a calico bandage, which is put on very gently, and rather for the purpose of securing the plaster and giving greater thickness and security to the whole, than for the purpose of compressing the joint. This is an important point, as otherwise an application which almost invariably affords security and ease, may occasion pain, with all its attendant mischief.

"In some cases in which the skin is thick and indolent, sufficient irritation will scarcely be excited by the above applications, and this may be promoted by rubbing on a small quantity of tartar emetic ointment previously to the application of the cerate. This, however, is rarely necessary.

"In some cases, also, it is desirable more effectually to prevent the motion of the limb, particularly in children. This may be done by applying on each side of the joint, externally to the plasters, a piece of pasteboard, softened by soaking in water, and cut into the length, breadth, and form of splints. These being soft, will accommodate themselves to the figure of the joint, and, when dry, effectually preclude all motion.

"I think this form of splint is infinitely preferable to those that are made of wood. It affords a very firm support to the limb, and at the same time counteracts the contracting effort of the muscles in as great a degree as can be effected without exciting inflammation. I have met with cases in which the diseased surfaces have been so forcibly compressed, by means of wooden splints, as to excite inflammation, and thereby cause a more violent contracting effect of the muscles, the resistance of which has aggravated the disease." (p. 133–37.)

Upon this plan of treatment, LAWRENCE justly observes:—"A question naturally arises, whether this free application of mercurial ointment to a large portion of the limb is of use in all the various diseases to which joints are liable; for it is recommended by the SCOTTS, without any distinction as to the nature of the affection, whether originating in the synovial membrane, or in the articular surfaces, or from scrofulous disease of bones. This is a point that must be solved by experience, and I cannot say that I am possessed of such as will enable me to answer the question. I think we should be rather inclined to ask another question on the subject, and that is, whether this free application of mercurial ointment to so large a surface of the body, and that too to a surface which not uncommonly includes some portion of ulceration, can be considered as perfectly safe. That is whether there may not be an absorption of the mercury capable of producing certain effects upon the constitution." LAWRENCE says he has seen this treatment adopted in a few instances, and in one "that the life of the child was nearly lost by the effect produced from the absorption of the mercury on the system. It caused a serious affection of the bowels, which, in the first place, shewed itself by pain, griping, and purging, and which then put on the appearance of a dysenteric affection, the child lost its appetite, became extremely thin, got a white tongue, and, in fact, seemed to be sinking as fast as it could. The dressings were, therefore, removed, and the child sent into the country, where it quickly recovered." (pp. 515, 16.) These observations are sufficient to prove that this treatment must be pursued with some caution, as some persons are more readily affected by mercurial applications than others, and in such serious mischief may accrue.

FRICKE (*a*) has seen good results from this treatment.

(*a*) Above cited.

243. In the *second stage*, thickening and loosening up of the ligaments having already occurred, exudation existing, and the affection of the bone having begun, the actual cautery and issues must be employed, after the proper subduing of the inflammatory symptoms, for the purpose of restraining, by external derivation, the deep-seated disease, and encouraging the absorption of the unnaturally secreted fluid. Three or four streaks are to be made with the prismatic cautery heated to whiteness, extending from the middle of the buttock over the joint, avoiding the skin upon the trochanter; and upon the skin behind the trochanter the flat of the iron is to be firmly pressed, for the purpose of making an issue. The burnt part is to be covered with soft linen, and, in severe pain, with anodyne bread poultices. When the slough has separated, the discharge is to be kept up with irritating ointments, of which, *ung. sabin.* is best. For the purpose of making an issue, a tolerably large patch behind the great trochanter is to be rubbed with caustic potash, slightly moistened, until the skin is brown (1). After some days the crust falls off, and a sufficient quantity of peas are to be introduced to keep up the suppuration. The suppurating part must be frequently touched with caustic.

Repeated and perpetual blisters, rubbing in tartarized antimony ointment, as also the application (2) of hot steam (*a*), and the introduction of a seton through the skin (3), especially in the region of the groin, if the pain more attack this part, and extend along the crural nerve, (FORD, BRODIE, LARREY, and others,) may reasonably be regarded as inferior to the more powerful means before mentioned.

The result of the burning is often remarkably quick. RUST objects to the use of caustic, that by its destructive operation on organic matter it does not produce sufficient excitement to effect an alteration of the soft and hard parts of the joint; numerous observations, however, prove the efficiency of issues. In the comparison of these two remedies, the momentary and severe operation of the hot iron is not merely to be considered, but the continued derivation, which is better supported by the issues than by the actual cautery. I therefore give the preference, in the second stage, to issues, if there be not great lengthening of the foot; but I prefer the actual cautery, or the burning cylinders, (recommended by ALBERS, LARREY, and others,) in all cases where the limb is much lengthened, the muscles relaxed, and where there is great swelling from collection of fluid. VOLPI (*b*) has not observed any effect from the application of the actual cautery, when the signs or precursors of coxalgy were first manifested not at the hip but at the knee-joint.

[(1) BRODIE'S observation, that "the good derived from the issue does not seem to be in proportion to the quantity of pus discharged from its surface," will, I am sure, be admitted by every one who is frequently in the habit of using them; and I fully agree with the opinion, "that sometimes more abatement of the symptoms is produced in the first few days after the caustic is applied, and before the slough has separated, than in several weeks afterwards," which, I presume, depends upon the fresh irritation produced by the new issue upon the skin; whilst, on the contrary, when an old issue is long kept up in one spot, the parts accommodate themselves to the intrusion, and after a certain period the issue is, as it were, naturalized, and causes no further inconvenience, and, consequently, no more benefit, as it fails to keep up the irritation required to create a diversion from the disease in the hip-joint. "This circumstance," says BRODIE, first led me, instead of employing beans for this purpose, to keep the issue open simply by rubbing the surface occasionally with the caustic potash, or with the sulphate of copper; and, after an extensive trial of both methods, the latter has appeared to be decidedly preferable to the former. The pain produced by the caustic is very considerable, but the relief of the symptoms is such, that I have known patients to be in the habit of making the application themselves, saying, that "they knew they should be better by the next morning." Besides, the issue managed in this way is more easily dressed than

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(*a*) Die Dampfmaschine, ein neues Heilmittel, oder über die Anwendung des Strahls der heissen Dämpfe des siedenden Wassers zu ärtzlichen Zweken; in DZONDI'S Æsculap., vol. i. p. 87; pl. i. 11. Leipzig, 1821.

(*b*) Above cited, p. 30.

where beans are used; and the inconvenience arising from the beans slipping out under the adhesive plaster, and from any accidental pressure of them against the sore surface, is avoided." (pp. 148, 49.) I have not any practical experience of this plan, being always in the habit of using glass beads, which quietly rest in the cavities they soon form for themselves, and when the wounds are disposed to heal, I brush them over slightly with caustic potash, which I have not found to give very much inconvenience; but I think Brodie's plan is likely to be preferable.—J. F. S.

(2) A very clever but simple apparatus for local steam-bathing invented by Duval(a), has been used in some of our hospitals for the last few years, and well deserves being more extensively adopted, on account of the facility with which it can be employed and the great benefit attained by it, especially in chronic diseases of the joints. "It consists of a reservoir for the water, capable of containing a little more than a pint, supported upon three metallic rods, and having a coverlet, which is furnished with two openings, one at the centre and one towards the side. From that in the centre arises a tube, terminating in a hollow globe, having attached to it and communicating with its interior three short branches, furnished with movable lids. A similar branch is connected with the opening at the upper edge of the reservoir. Beneath in a pan, supporting the parts already described, is placed a spirit-lamp, having four burners, and these, when lighted, quickly vaporize the water in the reservoir above. The steam is then conducted to the globe, and thence by means of short pipes slightly curved, and which may be connected with any one or all its branches at pleasure, to the part of the body required. The force and the quantity of vapour expelled is regulated by a key at the side of the principal cylinder, and which will diminish or enlarge its diameter, much on the principle of the ordinary stop-cock, while its escape upwards is entirely and instantly prevented by exposing the opening at the edge of the reservoir. The way in which it is used for joints is as follows: the patient covers the wrist, for instance, with a piece of flannel large enough for its edges to fall on a pillow, which is placed to support the fore arm. The nozzle of one of the tubes is then placed beneath the funnel, and the steam allowed to escape. The joint thus enveloped in steam has usually been allowed to remain for about half an hour; the application being made once a day or oftener, as the circumstances require. It may be also used as a vapour-bath, thus: the patient lies supine in bed, and three or four arches of wood or other convenient materials are placed across the body, so as effectually to raise the blanket from any contact with it. The apparatus is supported on a stool at the foot of the bed, and one of the pipes allowed to project into the arched cavity, which soon becomes filled with vapour. In this way all the inconveniences attending a removal to and from the bed are of course got rid of." (p. 205.)

(3) "The objections which may be urged," says Brodie, "against the application of caustic to the skin of the groin do not hold good with respect to a seton in this situation. I was led to adopt this treatment some years ago, partly from observing that the skin of the groin is nearer to the hip-joint than the skin elsewhere; partly from an expectation (though not a very confident one) that the making a seton over the trunk of the anterior crural nerve might be particularly calculated to relieve the pain referred to those parts to which the branches of that nerve are disturbed. The results of this practice more than realized whatever hopes I had entertained of its success. In many cases the seton occasioned very speedily a complete relief of the pain. In other cases, indeed, it failed in producing the like good effects; but these cases have borne only a small proportion to those in which it has succeeded. On the whole, I am led to conclude, that where the pain is very severe, the seton in the groin is more calculated to afford immediate relief than the caustic issue; but that it is not so efficacious in checking the progress of the disease, as it is in lessening the violence of its symptoms; and that the caustic issue can be better depended on for the production of a cure." (pp. 150, 51.)]

244. The good effects of this treatment is shown by the diminished pain, and by the gradual return of the foot to its natural length. Its effects are to be assisted by rubbing in, at the same time, mercurial or iodine ointment. The observance of complete rest is here also indispensable. If, from this improvement, there should be again a relapse without any decided cause, the prognosis is very unfavourable. The repeated application of the actual cautery is sometimes effectual. When all symptoms of the disease have subsided, the patient must still be kept quiet for a long while, and the suppurating parts must not quickly be checked. During convalescence sulphur

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(a) Provincial Med. and Surg. Journ., Dec. 1840.

baths may be advantageously used, and issues inserted in the arm to keep up continual derivation.

In this stage, also, I do not consider the use of warm bathing proper, (Rust, Brodie, and others,) on account of the motion therewith connected. The use of mercurial ointment has been prescribed in various ways: Fritz (*a*) employs Louvrier's treatment, but not so as to produce salivation; Rust rubs in daily one or two drachms; Jæger justly considers this as too strong a dose, inasmuch as it frequently produces too speedy salivation, which, in scrofulous subjects especially, is always to be avoided; he therefore rubs in mercurial ointment, in increasing doses from ten to sixty grains, to which he adds about five grains every three or four days, so that altogether from one to three ounces are used; and, when salivation has commenced, he changes it for iodine or white precipitate ointment.

[Brodie very justly lays great stress not only on rest but also on the patient's position. He says (*b*):—"When the cartilages of the hip are ulcerated ,the patient should be confined to his bed or couch, being never allowed to move from it on any occasion. If left to himself, he is generally inclined to lie on the side opposite that of the disease. There are, however, good reasons why this position should be avoided, if possible. It necessarily distorts the pelvis and increases the disposition to a lateral curvature of the spine. It also, in those cases in which the round ligament of the joint is destroyed, facilitates the escape of the head of the femur from the acetabulum and the production of dislocation. Something may be done towards preventing this last by interposing a pillow or thick cushion between the knees; and it is difficult to do more than this, after the patient has already been lying on his side for a considerable time: otherwise he should be placed on one of the bedsteads invented by Mr. Earle, lying on his back, with the shoulders and thighs somewhat elevated and the latter as nearly as possible parallel to each other. On some occasions, however, it is convenient to fix the pelvis by a strap or bandage, passing over it, from one side of the bedstead to the other; and even the thigh may be fixed in the same manner. At a later period when, in consequence of the extensive destruction of the articulation, the muscles begin to cause a shortening or retraction of the limb, I have found great advantage to arise from the constant application of a moderate extending force, operating in such a manner as to counteract the action of the muscles. For this purpose an upright piece of wood may be fixed to the foot of the bedstead, opposite the diseased limb, having a pulley at the upper part. A bandage may be placed round the thigh above the condyle, with a cord attached to it passing over the pulley and supporting a small weight at its other extremity. I will not say that the effect of such a continuance is to prevent the shortening of the limb altogether; but I am satisfied that it will, in a number of instances, render it less than it would have been otherwise, at the same time preventing, or very much diminishing, that excessive aggravation of the patient's sufferings with which the shortening of the limb is usually accompanied." (pp. 145, 6.)]

245. The general treatment in the first two stages of coxalgy is directed by the degree of the inflammation, and the nature of its cause. In severe acute inflammation, whether the origin be traumatic or otherwise, more than proper antiphlogistic treatment and attention to diet is superfluous. If the inflammation be chronic, the choice of internal remedies is to be directed according to the cause. In rheumatic and scrofulous patients, I have always found cod-liver oil in increasing doses, and, in torpid scrofulous subjects, the internal use of iodine, (after Lugol's plan,) the most efficient. We may consider that both these causes are combated by the various remedies which have been recommended in coxalgy.

Jæger recommends tartar emetic in large or small doses, Zittmann's decoction in divided doses; Rust, Dieffenbach, and others, use cod-liver oil; also the *decoct. ballotæ lanatæ*, the *extract. pampinorum vitis viniferæ* ʒj. to ʒij. daily, or a saturated decotion, or the recently expressed juice, (Frank, Rust, and others,) calomel, kermes mineral, *sulphur. aurat.*, turpentine, and so on.

Fricke recommends, in coxalgy, (in the above given sense,) rest and fixing of the limb by an apparatus. If the thigh remain longer, this passive treatment is not sufficient, and a two-fold condition must be distinguished; 1st, an irritable state of the nervous system, in which the patient complains of this and that, has disturbed digestion, chyli-

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(*a*) Salzb. Med.-Chir. Zeitung, 1828, No. 37.

(*b*) Third Edition.

fication and assimilation, and stoppage of the bowels, for which mild purgative remedies of various kinds, warm baths, and, locally, warm poultices must be used; 2nd, muscular weakness, — for which there should be advised, as most efficient, rubbing in volatile ointments, blisters, plasters of tartar emetic, dry cupping, stimulating baths, and steam of hot water, moxas, and actual cautery applied superficially only.

246. If the head of the thigh-bone become displaced, and the disease arrested, an artificial joint may be produced by continued rest; and, when the patient begins to walk, he must support the foot as much as possible, at first with crutches, and afterwards with a high shoe corresponding to the shortening of the extremity. The great degree of lameness, and, in children especially, the frequent contraction of the thigh, have led some to attempt the reduction of the luxation; and the results which have thereby been obtained, are well suited to determine on careful attempts at reduction, and then to keep the limb in a straight position, which is best done with **Hagedorn**'s apparatus for fracture of the neck of the thigh bone. If the reduction cannot be effected, we may attempt to keep the limb in its proper place, and the head of the bone in the neighbourhood of the socket, by gentle, gradually increased, and continued extension, by means of the apparatus just mentioned, or of some other kind, and so decidedly improve the direction and length of the limb in the course of the cure.

Owing to the nature of the circumstances under which the reduction is here attempted, it frequently does not succeed; and, indeed, when not employed with the greatest circumspection, very serious consequences may ensue. But, upon these grounds, to reject these experiments, and to consider their success impossible, (**Petit**, **Callisen**, and others,) or to imagine that if they actually succeed, the head of the thigh-bone cannot be fixed in the hip-socket, is opposed, according to **Jæger** (*a*), to all the under-mentioned observations. **Berdot** (*b*) reduced, by pressure, the head of the thigh-bone, dislocated upwards; **Hagen** (*c*), by means of **Ravaton**'s reductor. **Ficher** (*d*) and **Thilenius** (*e*) relate similar cases. **Mozilewsky** (*f*) undertook the replacement thrice with success; in the first case he succeeded in a luxation of several inches, and of several weeks' standing, without difficulty, but it was necessary to maintain it by constant pressure; in the second, it was not until after nine months', and, in the third, after five weeks', continued extension. **Schneider** (*g*) replaced the head of the thigh-bone, but it was always again dislocated, in spite of the splint which he applied. B. **Heine** (*h*) employed continued and gradually increased extension for a year, in a girl eleven years old, who had a spontaneous luxation of eight years' standing, with a shortening of three inches, and a considerable lateral curvature of the spine; the head of the thigh-bone not only retained its place in the joint, but the thigh moved as perfectly as the other, so that the girl could dance. F. **Humbert** and M. N. **Jacquier** (*i*) profess, by means of a proper apparatus, to give to the short limb similar length with the healthy one, to restore the head of the bone to the socket, and to confine it there till, by increased muscular energy, the necessary connexion and firmness are attained. **Textor**'s observation of a case of long standing dislocation of the head of the bone, being driven back into the joint by a fall upon the rump, is extremely interesting: this he himself related to me. **Volpi**, **Schreger**, von **Winter**, **Harless** (*k*), and **Fricke** (*l*), have recommended gentle and continued extension, with proper fixing of the limb. There would be always decided advantage if, in cases in which replacement does not succeed, the head of the thigh-bone were brought down from the back of the hip-bone into the ischiatic pit, and there fixed. J. **Heine** (*m*) has communicated most interesting and successful observations upon four cases in which he happily effected the reduction with permanent success. In one case he had the oppor-

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(*a*) As above, p. 597.

(*b*) Act. Helvet., vol. iv. p. 236.

(*c*) Wahrnehmungen. Mietau, 1772.

(*d*) Salzb. Med.-Chir. Zeitung, 1807, vol. iv. p. 381.

(*e*) **Hufeland**'s Journal, 1816, May, p. 102.

(*f*) **Schreger**; in **Horn**'s Archiv., 1817, vol. i. p. 316.

(*g*) Chirurgische Geschichten, Chemnitz, 1763, vol. ii. p. 77.

(*h*) **Jæger**, above cited.

(*i*) Essai et Observations sur la manière de réduire les Luxations spontanées ou symptomatiques de l'Articulation Ilio-fémorale, méthode applicable aux Luxations anciennes par cause externe. Paris, 1835. Atlas folio.

(*k*) Jahrb. der deutschen Medicin, vol. iii. part i.

(*l*) Fünfter Bericht über die Verwaltung des allg. Krankenhausses zu Hamburg.

(*m*) Ueber spontane und congenitale Luxationen, u. s. w. Stuttgart, 1842.

tunity, after the subsequent death of the patient, to examine, by dissection, the reduction and condition of the joint.

247. If collections of pus take place, which are often very far spread, and accompanied with much pain and increased hectic consumption, they must be opened with a sufficiently large cut, and care taken in the application of warm poultices for the proper escape of the pus; and the powers of the patient are to be kept up by tonic remedies and good diet. In scrofulous persons, the cod-liver oil is particularly advantageous. If collections of pus take place after acute coxalgy, a speedy cure often takes place under the preceding mode of treatment. The same course must be pursued with fistulous passages.

Different opinions are held as to the treatment of these abscesses, in reference to their dispersion by the application of caustic (FORD,) of seton (WEND, VAN DER HAAR,) of actual cautery (RUST.) BRODIE and JÆGER have never seen any result from the actual cautery, and my experience is the same. The greatest number of Surgeons leave the opening of these abscesses to nature, in which case the pus flows out more slowly, and the hectic consumption does not increase in the same degree as in the artificial opening: they advise only, in great and continued tension, and constant uncontrollable pain, a simple puncture; whilst others recommend an early opening. The aperture itself is advised to be made by caustic, (SABATIER, FICHER,) by the red-hot trocar, (LARREY,) and by the actual cautery (RUST.) The latter further recommends drawing a seton through the whole joint, by means of a trocar and an edged probe, in order that, after remaining there a few days, it may produce a severe inflammatory process in the deep-seated parts, a mode of proceeding which is certainly more likely to hasten death than improvement. Larger incisions, as recommended specially by BRODIE, JÆGER, and others, have certainly the preference over the above-described mode of treatment, and more simply and satisfactorily support nature in throwing off the diseased bone, and so on. Injections of decoction of bark, of oak bark, or of walnut leaves, with tincture of myrrh, turpentine, and so on, are useless, and nearly always injurious.

[As regards the opening of abscesses at the hip, BRODIE notices, that "an abscess connected with any joint, but particularly one connected with the hip, does not form a regular cavity, but usually makes numerous and circuitous sinuses in the interstices of the muscles, tendons, and fasciæ, before it presents itself under the integuments. It is, therefore, less easy to evacuate its contents, than those of an ordinary lumbar abscess; and, indeed, it can seldom be emptied without handling and compressing the limb, in order to press the matter out of the sinuses in which it lodges. But this is often attended with very ill consequences. Inflammation takes place of the cyst of the abscess, and pus is again very rapidly accumulated. Small blood vessels give way on its inner surface, the bloody discharge of which, mixed with the newly secreted pus, goes into putrefaction, and exceedingly irritates the general system." (p. 160.) He, therefore, states:—"The practice which has appeared to me to be, on the whole, the best, is the following:—An opening having been made with an abscess lancet, the limb may be wrapped up in a flannel wrung out of hot water, and this may be continued as long as the matter continues to flow of itself. In general, when a certain quantity has escaped, the discharge ceases; the orifice heals, and the puncture may then be repeated some time afterwards; but where the puncture has not become closed, I have seldom found any ill consequences to arise from its remaining open." (p. 161.)

On the whole, I think it preferable not to meddle with abscesses of the hip-joint, unless they excite much constitutional irritation, until the skin is on the point of ulcerating; then they may be punctured, and rarely untoward symptoms follow.—J. F. S.]

248. If, under this treatment, the general and local condition improve, if separate pieces of bone are thrown off, which are removed in the usual way, one or other opening, however, generally remains fistulous, and may so continue, without detriment, for years; often closing after repeated separations of bone, or, in younger persons, they close on the approach of puberty. If the carious destruction, however, continue, and the hectic consumption be in no way checked, examination must be made with the finger merely, of the caries of the head of the thigh-bone, and if the soft parts are not too much undermined and destroyed, the cutting off the head of the thigh-bone;

and, in greater destruction of the soft parts by the burrowing of the pus, provided the powers are not too much exhausted, the exarticulation of the thigh-bone is the only, although very doubtful, means for the possible recovery of the patient. The circumstance of the hip-socket being usually affected in carious destruction is principally against this operation.

The amputation of the head of the thigh-bone (as recommended by **Jæger**) has been proposed by **Kirkland**, **Richter**, and **Vermandois**, instead of the more dangerous exarticulation, was successfully performed by **White**, and, without benefit, by **Hewson**. **Kerr** and **Baffos** performed the exarticulation of the thigh-bone without advantage. In both cases the hip-bone was affected; in **Baffos's** case, however, death occurred three months after, and when the wound was perfectly healed. **Charles Bell's** proposition (a) to saw through the neck of the thigh-bone, in order to produce anchylosis by the quietude of the head of the thigh-bone (!) is decidedly less suitable.

[**Coulson** mentions ,as an instance of spontaneous reduction of a thigh-bone dislocated by hip-disease, the following case, communicated to him by **Barry** of Richmond. It will be seen, however, from the account, that the replacement was *not* effected spontaneously, but rather by the nurse lifting the head of the bone over the edge of the socket into its proper place. It is, however, a very interesting—

Case.—I. S., aged forty years, who had been for a number of years employed in carrying the produce of a market-garden to town, and generally by night, and had of late years suffered from rheumatism and occasional hepatic derangement, was, in February, 1836, labouring under the most aggravated form of ulceration of the cartilages of the hip-joint, induced by a fall from a cart on the frozen ground about a month before. In the following month luxation had taken place on the *dorsum ilii ;* the head of the femur can be felt, and the limb is shorter by about three inches and a half, with a slight inversion of the foot." Suitable treatment was adopted, and in the May following extension was made for a few days, "to relieve the pain caused by the unusual action of the *m. glutæi*, and for about four days the intention was fully answered by these means; but the extension becoming a source of irritation, was discontinued two days after, being 2nd of June; and about seven weeks from the time of extension, while the female attendant was helping him to turn in bed, with her right hand on the inside of the thigh, and her left between the acetabulum and the new position of the head of the femur, the bone was felt by her hand rushing past this intermediate space. Next day," says **Barry**, "I found the limb restored to within half an inch of its proper length, with neither inversion nor eversion of the foot, and pain gone. The patient says he heard the sudden 'snap,' and exclaimed, at the same time, that mischief had been done! It was, as has been seen, unlooked for reduction. In November following, the man walked about on crutches, and had not any pain." (pp. 103, 4.)

Ducros's case already mentioned appears to have been cured by continued extension for fifty days.]

II.—INFLAMMATION OF THE SHOULDER-JOINT.

(Omalgia, Omarthrocace.)

249. This disease runs through the same three stages as coxalgy.

The pain, at the onset a more constant symptom than in coxalgy, is tearing, darting at one part or other and descending to the elbow. It is felt when pressure is made with the finger in the arm-pit directed forwards. The arm wearies with but slight motion, and the pain is increased every time it is moved, especially when raised. No disease is distinguishable on the shoulder. The pain increases after some time, especially at night. The sensibility and weakness of the arm become very great.

250. Gradually the arm becomes bent at the elbow-joint, and sticks out from the body; every movement of it becomes painful: it grows flabby and wastes. The shoulder sinks in, and loses its rounded form ; the folds of the arm-pit also grow deeper ; between them the head of the bone is felt, and the arm-pit is more filled. The diseased arm seems longer when compared with the healthy one. Often also, the shoulder swells, becomes more

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(a) London Medical Gazette, 1828, Jan.

rounded, and the skin itself reddened and hotter. Febrile symptoms accompany the exacerbations which occur at various periods.

251. If the head of the bone escape from the socket, the curved form of the shoulder is entirely lost; the acromion juts out; in the arm-pit, the sunken head of the bone is felt, which gradually softens above towards the collar-bone, so that the arm is somewhat shortened and directed backwards, and its motion hindered: or, the swelling of the shoulder increases, becomes harder and more painful on pressure, and on every motion of the arm.

Here, as in coxalgy, collections of pus take place, which, in the end, burst, and form fistulous passages. Carious destruction of the head of the upper arm-bone, of the socket, of the ribs, and so on, occur, and profuse suppuration, which destroys the powers of the patient. In favourable cases, a new socket is formed for the head of the upper arm-bone, or it anchyloses with the shoulder-blade.

252. On examination of the joint after death, the cartilaginous covering of the head of the bone, and of the socket of the blade-bone, is found either partially or entirely destroyed; carious destruction of the bone, which generally does not reach far down the shaft of the upper arm-bone; frequently the head of the bone is swollen up, covered with fungous growths, its cells enlarged and filled with blood or yellowish red exudation; the capsular ligament and surrounding tissue thickened and loosened up, the synovial membrane degenerated; pus poured out into the cavity of the joint, and into the various muscular interspaces.

253. The etiology, prognosis, and treatment, correspond with those laid down in coxalgy.

III.—INFLAMMATION OF THE KNEE-JOINT.

(Weisse Kniegeschwulst, Tumor Albus Genu, Gonalgia, Gonarthrocace.)

254. The pain is at first generally very trifling; the patient feels rather a stiffness of the knee-joint, and the pain only comes on with active motion. Sometimes it is confined to one spot, sometimes spread over the whole joint. This state may often continue for a long while, with alternate improvement and relapse; the pain at last increases, and the joint begins to swell. Freqnently the pain is severe from the first, and the swelling soon appears. In many cases it is elastic and fluctuating, but has not the form of the joint; in others it yields but little to pressure, and is often so hard that it might be taken for bone. In proportion as the swelling of the knee increases, the leg becomes more bent; walking becomes very painful, or quite impossible; the skin over the swelling is shining white, exceedingly stretched, and at last bluish through the swelling of the veins. The pain now increases to a great degree; the swelling becomes at some parts distinctly fluctuating; the skin grows red and thin: it bursts, and discharges thin pus, mixed with cheese-like flakes. The openings often close and break out afresh. In general, the powers of the patient sink very rapidly; a probe passed into the joint shows carious destruction; hectic fever, with colliquative diarrhœa, comes on with more severe pain in the knee-joint, and death ensues, if the limb be not removed in proper time. The duration of the disease is uncertain.

255. What has been already said as to etiology applies here. The difference in the course of the disease depends on whether it has commenced as inflammation of the ligaments and synovial membrane, or as ulceration

of the cartilages of the bones. Hence arises the earlier division of white swelling of the knee-joint into *rheumatic* and *scrofulous.* In the former, the disease of the knee is more general, and the swelling occurs more quickly after the setting in of the pain; the synovial membrane, and the soft parts of the knee, are primarily attacked: in the latter, the pain is fixed to one particular spot, and the swelling, which retains the form of the knee, takes place later, and is more hard.

This difference in the swellings of the knee is confirmed by examination of the diseased joint after death. The soft and hard parts of the joint are often completely changed, and so connected together by a tough thick lymph, that they form a perfectly fungous mass. The synovial membrane is often inflamed and ulcerated, and the cartilage at the same time degenerated into a red spongy mass. All the soft parts of the joint are often thickened, as is also the cellular tissue on the external surface of the capsular ligament. The cavity of the joint is filled with brownish flocculent fluid. The cartilaginous surfaces are often partially or entirely destroyed, and the bones are carious. The head of the shin-bone is more usually affected with caries than the joint-end of the thigh-bone. The soft parts of the joint may be completely destroyed, and the carious ends of the bones exposed.

[The following is a brief account of the symptoms by which diseases of the knee may be distinguished:—

In synovial inflammation of the knee-joint, the swelling, which at first depends only on the increased quantity of fluid contained within, is readily and "distinctly felt to undulate when pressure is made alternately by the two hands placed, one on each side. When the inflammation has existed for some time the fluid is less perceptible than before, in consequence of the synovial membrane having become thickened, or from the effusion of lymph on its inner or outer surface; and, in many cases, where the disease has been of long standing, although the joint is much swollen, and symptoms of inflammation still exist, the fluid in its cavity is scarcely to be felt. As the swelling consists more of solid substance, so the natural mobility of the joint is in a greater degree impaired. * * * The swelling is not that of the articulating ends of the bones, and therefore it differs from the natural form of the joint;" * * * depending "in great measure on the situation of the ligaments and tendons which resist the distension of the synovial membrane, in certain directions, and allow it to take place in others;" thus, "the swelling" says **Brodie**, "is observable on the anterior and lower part of the thigh, under the extensor muscles, where there is only a yielding cellular structure between those muscles and the bone. It is also often considerable in the space between the ligament of the patella and the lateral ligaments; the fluid collected in the cavity causing the fatty substance to protrude in this situation, where the resistance of the external parts is less than elsewhere." (pp. 24, 5.)

The swelling from synovial effusion is easily distinguishable from the large fluid swellings of the bursa of the knee-cap by the latter being always in front and of a rounded form, whilst the former is on the sides of the knee-cap. It may, however, be confused with collections of fluid in the hamstring tendons, which sometimes occur, as those tendons pass on the sides of the joint to their insertion in the leg; but the nature of the latter is shown by their more circumscribed extent, and by not undulating through the joint.—J. F. S.

The pain in this complaint, though increased by motion, and by pressure with the fingers, is not, at least in the early stage, increased by pressing the cartilages together; but when adhesive matter is effused, and the cartilage is ulcerating or absorbing, there is pain more or less severe according to the mischief going on. In the pulpy disorganization of **Brodie**, as already mentioned, (p. 217,) the disease begins with a slight degree of stiffness and swelling, without pain, and the symptoms gradually increase. The form of the swelling is "less regular, is soft and elastic, and gives the sensation as if it contained fluid; * * * but if both hands be employed, one on each side, the absence of fluid is distinguished by the want of fluctuation." (p. 103.) There is not generally much pain till abscesses begin to form, and the cartilages ulcerate. The progress of the disease is slow.

"When the cartilages of the knee are ulcerated," says Brodie, "there is pain in the affected joint; at first slight, and only occasional, and, in the early stages of the disease, it is completely relieved by remaining in a state of rest for a few days, but it returns as soon as the patient resumes the exercise of the limb. By degrees the pain becomes constant, and very severe, particularly at night, when it disturbs the patient by continually rousing him from sleep. The pain is referred principally to the inside of the head of the tibia, but sometimes a slighter degree of pain extends down the whole of that bone. The pain is aggravated by motion, so that the patient keeps the limb constantly in one position, and generally half bent; and he never attempts to support the weight of the body on the foot of this side." It is distinguished from inflammation of the synovial "membrane in this, that the pain in the former is slight in the beginning and gradually becomes very intense, which is the very reverse of what happens in the latter." From most other diseases of this joint it differs, in that "the pain in the first instance is unattended by any evident swelling, which comes on never in less than four or five weeks, and often not until several months have elapsed from the commencement of the disease." (pp. 167, 68.) The swelling Brodie describes to "arise from a slight degree of inflammation having taken place in the cellular membrane external to the joint, in consequence of the disease within it. The swelling is usually trifling, appearing greater than it really is, in consequence of the wasting of the muscles of the limb. It has the form of the articulating ends of the bones, that is, the natural form of the joint. No fluctuation is perceptible, as where the synovial membrane is inflamed, nor is there the peculiar elasticity which exists where the synovial membrane has undergone a morbid alteration of structure." (p. 170.) When ulceration of the cartilages has taken place, striking the heel so as to jar the knee, or rubbing the ends of the bones together, though but slightly, causes severe pain, and if there be much destruction of cartilage, a grating sensation is conveyed along the leg to the surgeon's hand. "The progress of the ulceration of the cartilages," Brodie observes, "varies, with respect to time, in different cases; but it is generally tedious. In one case, where violent pain had existed in the knee, with little or no swelling, for two years and a-half previous to amputation, I had," says he, "an opportunity of examining the diseased joint, and found the cartilages destroyed for only a small extent; a drachm and a-half of pus in the articular cavity, and no morbid appearance of the soft parts, with the exception of a very slight inflammation which had been induced in the synovial membrane, and the effusion of a minute quantity of coagulable lymph into the cellular texture on its external surface." (pp. 174, 75.)

Since the observations referring to ulceration of cartilage, from pressure of adventitious membrane, have passed through the press, I have had the opportunity of examining with the microscope, both the adventitious membrane and cartilage, in the case of a boy aged ten years, whose knee having been affected with disease for four years, was removed by the wish of his friends on the 17th of this month, (May, 1845.) In this case I saw distinctly the vascular loops in the adventitious membrane, already quoted (p. 232) from Goodsir's paper; and also the peculiar degeneration in the cartilage which my friend Rainey has described as follows:—

"A vertical section through the joint on one side of the patella exposed adventitious membraneous structures, extending from the synovial membrane towards the interior of the joint, and lying against the articular cartilage, which was excavated in such a manner as to have the exact form of the membrane in contact with it. These structures were of different forms and degrees of thickness in different parts of the joint, and always continuous with the synovial membrane.

"In some parts of the joint, the articular cartilage of the femur, and that of the opposite part of the tibia, were completely destroyed, and the denuded osseous surfaces of these bones, connected by a newly formed fibrous structure, which was sufficiently long to allow of considerable motion. The free surface of the articular cartilage was, in some parts, covered by a thin layer of membrane, which admitted easily of being detached, in other parts excavated, as before observed; the opposite surface was either completely detached, or only loosely connected with the bone. Some abscesses communicated with the joint.

"The microscopic examination of the membranous productions showed that they were vascular, the vessels forming loops *towards the cartilage*, which I have observed in other cases that have been better injected. But what seems most interesting is, that the absorption of the cartilage is preceded by its fatty degeneracy, diminishing in degree from its free surface to the one connected with the bone.

"This degeneracy is first perceptible by the division of the nuclei of the cartilage cells into several minute spherical particles of oil. These particles increase as the nuclei lose their natural appearance, and at length the cartilage cells become entirely filled with oily matter. Although the microscopic characters are sufficient to show the real nature of this matter, I acted upon it with æther, which took up a considerable portion, and after evaporating, left it on the glass thus confirming the information derived from the microscopic examination. The intercellular matter, sometimes called hyaline, like the nuclei of the cells, becomes also converted into oil, the minute particles of which are arranged in irregular lines running in all directions, and thus grooving and excavating the cartilage, they produce its gradual removal.

"I am disposed to think that this mode of degeneracy of cartilage, by its reconversion into a substance more absorbable than itself, and less nitrogenized,—a kind of process exactly the reverse or counterpart of nutrition,—has not been observed by those who have written upon these diseases."—GEO. RAINEY.

In the scrofulous disease of the cancellated structure of the bones, BRODIE says:—"Before it has extended to the other textures, and while there is still not evident swelling, the patient experiences some degree of pain, which, however, is not so severe as to occasion serious distress, and often is so slight, and takes place so gradually, that it is scarcely noticed." The patient is able to go about often for a long while, hence "the swelling, though usually more in degree than it is, at the same period, in those cases in which the ulceration of the cartilages occurs as a primary disease, is not greater in appearance, because the muscles of the limb are not equally wasted from want of exercise. In children the swelling is, in the first instance, usually less diffused, and somewhat firmer to the touch, than in the adult. * * * The swelling increases, but not uniformly, and it is greater after the limb has been much exercised, than when it has been allowed to be in a state of quietude." (pp. 251, 52.)

"As the caries of the bones advances, inflammation takes place of the cellular membrane external to the joint. Serum, and afterwards coagulable lymph, is effused, and hence arises a puffy and elastic swelling in the early, and an œdematous swelling in the advanced stage of the disease. Abscess having formed in the joint, makes its way by ulceration through the ligaments and synovial membrane, and afterwards bursts externally having caused the formation of numerous and circuitous sinuses in the neighbouring soft parts. (p. 246.) As the cartilages continue to ulcerate, the pain becomes somewhat, but not materially, aggravated. It is not severe till abscess has formed. * * * The disease not unfrequently remains in this state for several months, or even for a much longer period, without the constitution being materially disturbed. (p. 252-54.)

"When the disease occurs in those joints which are more superficially situated, as the knee and ankle," BRODIE (*a*) says, "we may be further assisted in our diagnosis by observing the character of the swelling by which it is accompanied, and which is somewhat peculiar, especially in children, previous to the formation of abscess. It is then limited to the immediate vicinity of the affected part, and has a pretty well-defined margin. When the disease is in the knee, the child usually keeps the leg a good deal bent, and the condyles of the femur are seen projecting, of a somewhat globular form, and appearing as if they were actually enlarged, although we know them not enlarged in reality." (p. 202.) The principal distinction between this form of disease and primary ulceration is the less degree of pain.

In considering diseases of the knee-joint, it would seem improper to pass over without notice that which has been called

White Swelling.—This term has been so long, and so generally, applied to several different diseases of the joints, that its real meaning has been almost entirely lost sight of, and it is now only applied, by unprofessional persons in this country, to swellings of the knee-joint, of long endurance and great obstinacy; and even by some continental writers, as, for instance, VELPEAU, it has been made to include the whole class of disorders affecting both the soft and hard parts of joints, though he has chosen to designate them with the classical title *Arthropathie,* (diseases of joints,) which has been coined for the purpose, in preference to the other equally mystic name, *Arthrite,* (inflammation of joints.) Yet the term White Swelling, had a special signification, and designated an important and dangerous, though not malignant, disease, and, within a few years, its right to be distinguished as a peculiar form, has been asserted and proved by NICOLAI of Berlin, who published, in Paris, a very clever thesis, entitled *Mémoire sur les Tumeurs blanches des Articulations;* which he reprinted, in 1832, with little alteration, in RUST's *Handbuch der Chirurgie,* in the article, *Fungus Articulorum.* I rather suspect he must have been well acquainted with RUSSELL's *Treatise on the Morbid System of the Knee-Joint,* in which a very excellent account of white swelling is given; but he has gone more carefully and extensively into the subject, as will be presently seen.

(*a*) Third Edition.

"There is, indeed, no country," says Russell, "in which white swelling more frequently occurs than in the island of Great Britain" (p. 53); a remark previously made by Götz, who speaks of it as "ligamenta articulationis genu præsertim afficiens morbus Britannis præ cæteros communis." (p. 15.) Morgagni mentions its unfrequency in Italy; and it would seem rare at Vienna, and in many other parts of Germany, where scrofula is much less prevalent than in the colder climates of the north.

Russell says it is called a *White Swelling*, "on account of the appearance of the complaint in its advanced stages, as the skin, in general, remains of its natural colour, however large the size may be which the swelling attains." Or it is named an *In-come*, in consequence of the slow and insidious approach of the attack, as the complaint often arises from insensible beginnings, and without any known cause. Russell's description of this disease is well worthy perusal, and if it be not a distinct disease, which, at the onset, it seems to me to be, it more resembles the disease of the cellular membrane of joints above mentioned, (p. 210,) as described by Wickham, than any other; whilst at its termination it has more close connexion with the results of synovial inflammation. I shall first give Russell's account of the appearances which the disease presents on dissection; and, though his account of the symptoms are deserving attention, yet, on the whole, I think it rather preferable to give Nicolai's statement on the latter points, as being rather in accordance with the present notions of disease.

The appearances on dissection "are," says Russell, "in general, sufficiently characteristic of the complaint. The great mass of the swelling appears to arise from an affection of the parts exterior to the cavity of the joint, and which, besides an enlargement of size, seem also to have undergone a material change of structure. There is a larger, than natural, proportion of a viscid fluid, intermixed with the cellular substance. And the cellular substance itself has become thicker, softer, and of a less firm consistence than in a state of health. Thus it approaches somewhat to the nature of a uniform pulpy mass, and by this means undulates when struck, so as to resemble the obscure fluctuation of a fluid, and, when gently and regularly pressed, applies accurately to all the little inequalities of the bone, presenting the appearance of a solid, permanent enlargement. The consistence of the swelling, indeed, varies considerably according to the duration of the complaint. When the swelling is recent, and has increased rapidly, the glutinous fluid is more liquid, and the cells which contain it more distinctly separated, so that the distinction between the fluid and solid parts is quite evident. But when the swelling is of an old date, and has grown by slow degrees, the whole of its substance becomes of a more homogeneous consistence, very much resembling a mass of soft cartilage, in which no diversity of parts is easily discernible. In this state the substance is too solid to communicate to the touch any sensation similar to the fluctuation of a fluid. Another circumstance which prevents the perception of any such symptom in those old cases, is the change which the skin undergoes, as it becomes thicker, firmer, and more insensible, approaching somewhat to the appearance which the skin assumes in cases of elephantiasis. The capsular ligament would appear to undergo a material alteration in its structure very soon after the commencement of the attack. It loses the firmness of its texture, and, as the texture becomes looser, the thickness of substance increases." Gotz says:—"Ipsa circa articulos *ligamenta turgent* ac tela quoque proxima ambiens, infarcta ostenditur, sic ut simul in densam, fungosam, quasi substantiam, mutentur." (p. 16.) "The external surface, too, in place of presenting a bluish colour, with somewhat of a shining lustre, is more of a dead opake white. But, in general, the most essential change is to be observed upon the inside of the ligament, which becomes covered with a layer of a soft substance, of a pale yellowish colour, and semi-transparent. This substance is often nearly one-eighth of an inch in thickness; it is commonly very soft on the inner concave surface, and firmer on the outer convex part, where it adheres to the inside of the capsular ligament with a considerable degree of firmness. In many places there is a very beautiful plexus of vessels, and at the interstice, between the surfaces of the femur and tibia, an appendage full of blood-vessels, particularly at its edges, frequently insinuates itself to the distance of nearly half an inch. This layer of adventitious matter seems to be composed of a lymphatic exudation, and, in this respect, may not so far differ from the nature of the effusion which forms the external swelling. The greater number of vessels proves the existence of a certain state of inflammation." (p. 30–3.)

The following is Nicolai's account of *Tumor albus*, as he calls this disease:—

"The disease has three stages, and runs sometimes a chronic, and sometimes an acute course. In the *first stage of the chronic form*, pain is observed from the very commencement, increasing on every movement of the limb, and a sensation of wearisomeness the joint, and these sensations wander from one place to another. Pressure does not increase, but rather diminishes, the pain, and, therefore, the patient swathes the limb with a bandage. Motion of the diseased joint is difficult, and increases the pain and sensation of fatigue. The colour of the skin is unchanged, nor is there any swelling, but the temperature is somewhat increased, and motion of the limb produces crepitation in tho joint. The pain and sensation of weariness increase when the patient warms in bed, and destroys his sleep. After these symptoms have continued some weeks, and the girth of the joint has increased, the *second stage* sets in. The swelling of the joint is at first pale, free from pain, and most so where, at first, the pain was most severe; it is soft, fungous, elastic, and somewhat hotter than the other parts. When pressed no pitting is produced, but merely a paleness on the skin. The swelling involves the greater part of the joint, and at last engages it completely; the skin appears shiny; the pain becomes more severe; the movement of the limb difficult and painful (*a*). On account of the pain the patient bends the knee, and in this continued position the tendons becomes rigid, so that in the end both flexion and extension become impossible. The pain and tension are specially situated in the knee-cap; therefore, in motion of the limb, the patient fixes it with his hands. The veins glimmer through the shining skin, the whole of which is bluish and reddish. If the joint swell, the limb shrivels below it, so that at last it seems to consist only of skin and bone, and the skin is exceedingly loose. In the *third stage* some spots of skin become redder and projecting, the veins show more distinctly through, the skin here becomes thinner and softer, and fluctuation beneath is felt; the wasted lower part of the limb becomes œdematous, and every part discharges, when opened by nature or art, a bloody, puriform, ichorous fluid. If the probe be introduced, the bone is felt carious, or deprived of periosteum, or the tendons and ligaments, and may be moved in all directions. And now, under continued suppuration of the joint, the well-known general symptoms occur with fatal result. In the *acute form* a rheumatic fever not unfrequently precedes the swelling, with wandering pain in all the joints, and, after a day or two, the pain and swelling fixes very decidedly in one joint, forming the commencement of *Tumor albus.* The joint is red, swollen, and extremely painful, so that it cannot bear the least touch or movement; the skin is shining and burning; pressure diminishes the redness, but leaves no pit; fluctuation is sometimes felt, which depends on much synovia. The pain becomes especially severe when the person is warm in bed. The swelling occupies the whole joint, and stretches to the neighbouring parts of the limb. After some days it acquires its greatest extent, and is often quite extraordinary; but the circumference of the bone is unchanged, and the pain is not deep seated. When the fever has continued some days, the fever diminishes, or entirely subsides; the swelling loses its rosy colour, does not diminish, but rather increases; is usually soft, pale, and flabby, so that the finger when pressed on it causes a pit. The heat and pain subside, and the swelling now becomes chronic, as if from acute rheumatism; such is the so-called acute rheumatic species of *Tumor albus.* The joints, rich in cellular tissue and aponeurotic parts, and the articular parts are especially attacked by this disease, which, in its subsequent course, becomes chronic.

Anatomy of *Tumor albus.*—In the *first stage* of the disease, the soft parts of the joint, the cellular tissue which surrounds the tendons and ligaments are very full of blood, which is specially collected in the small vessels of the cellular tissue. The latter appears to be in large quantity; at least, there is formed a yellowish white substance which coagulates, resembles lymph mixed with jelly, and is in largest quantity near the tendons and ligaments. (At the knee-joint, it appears first on the lateral and posterior, then on the anterior, part; at the elbow, on the sides and behind; on the foot, at the sides of the ankle.) The deep parts of the joint seem little changed, only the periosteum and synovial membrane are redder, and have reddish dots and points; at some parts the synovial membrane is thicker, softer, and closely connected with the above-mentioned gelatinous mass. In the *second stage,* the *Tumor albus* contains, in the cellular tissue and around the tendons, a fibrous, thick, tough substance, not unlike lard, in which run white threads, connecting the skin to the deep parts. The blood-vessels are less numerous than in the first stage; but injection shows that every white thread is only a large vessel, which, on account of the thinness of its walls, rather resembles a vein; the arteries also may be distinguished, although, for the most part, they are obliterated. The lardaceous mass is softer than the integument and tendons, which parts, although covered with this substance, are perfectly healthy; a proof that the *Tumor albus* is situated only in the cellular tissue surrounding it. In some parts of this substance, especially in the neighbourhood of large vessels, blackish-red spots are found, which contain a softer, cheesy, livid matter.

(*a*) RUST observes on this point: "The patient complains of the sinews being shortened, which is explicable by the ligaments and tendons in the neighbourhood of the joint having their motions interfered with, and being compressed by an immoderate deposit in the cellular tissue surrounding them."—*Handbuch,* p. 556.

In the *third stage*, there is always found, beneath the skin, in the cellular tissue, a red bloody ichorous fluid; the soft parts, skin and cellular tissue, easily melt, and are like jelly; bones, tendons, and ligaments are found covered with a white cheesy substance. The capsular membrane is soft, thickened, and grayish-red; in the cavity of the synovial membrane there is also found a cheesy gray matter, which sticks tightly to its walls. If there be ulcers, the bones are stripped of periosteum, rough, and covered with an ichorous pus-like matter. The ulcers form fistulas which pass in all directions, backwards and forwards through the lardy mass to the bones and cartilages, are lined with a soft membrane, to, and upon, which, at different parts, large vessels proceed and ramify. The mass of vessels is in this stage less than in the two former; the large veins and almost all the arteries are obliterated." (pp. 149-153.)

256. The prognosis and treatment are determined by the different seat of the disease, according to the foregoing rules.

IV.—INFLAMMATION IN THE JOINTS OF THE VERTEBRÆ.

(Pott's Disease, Spondylarthrocace.)

257. This disease may take place in all parts of the spinal column, and its symptoms vary accordingly.

Sometimes without any cause, sometimes after a fall or contusion, after catching cold, or after debility from masturbation, pain occurs in the spinal column, which is variable and indistinctly marked, and which increases and diminishes, without entirely subsiding. The spine does not present, upon examination, the least change. Pressure does not increase the pain. After a time, projection of one or more spinous processes is noticed; the motions of the body are unsteady; the patient can still walk, but he soon tires; the pain increases, and fixes itself at the projecting part; movement of the feet becomes more difficult; they at last lose their sensibility, and become quite paralysed; at the same time there are symptoms of palsy of the bladder and rectum (1). According to the different seat of the disease on the lumbar or dorsal *vertebræ*, the patient has distension of the belly, weight at the stomach, pain along the ribs, pain in the lower limbs, shortness of breath, attacks of suffocation, and symptoms of phthisis; finally, collections of pus appear under the crural arch, in the inguinal canal, in the neighbourhood of the rectum, on the sides of the spine, and so on (2). In such cases hectic fever soon destroys the powers of the patient. In rare cases, the collected pus makes its way inwards, into the belly, into a bowel, into the cavity of the chest, or into the lungs, as I have once seen.

This disease is often, at first, unaccompanied by pain (3); the spinous processes jut out, without the patient suspecting any disease at this place; subsequently he complains of weight in the legs; they soon get tired, and suffer spasmodic contractions; collections of pus form more rapidly. Often the spinous processes do not jut out, especially if the ulceration be spread over a large extent of the spine. In the dorsal and lumbar *vertebræ*, the curving of the spinal column usually occurs as an angular projection backwards; sometimes it also projects sideways, sometimes in that direction only, and in the most rare cases the projection is forwards (4).

[(1) Pott says:—"To this distemper both sexes and all ages are equally liable. * * * When it attacks an infant of only a year or two old, or under, the true cause of it is seldom discovered until some time after the effect has taken place, at least not by parents and nurses, who know not where to look for it. The child is said to be uncommonly backward in the use of his legs, or it is thought to have received some hurt in the birth. When it affects a child who is old enough to have already walked, and who has been able to walk, the loss of the use of his legs is gradual, though in general not very slow. He at first complains of being very soon tired, is languid, listless, and unwilling to move much, or at all briskly; in no great length of time after this he may be observed frequently to trip and stumble, although there be no impediment in his way; and whenever he attempts to move briskly, he finds that his legs involuntarily cross each other, by which he is frequently thrown down, and that without stumbling: upon endeavouring to stand still and erect without support, even for a few minutes, his knees give way and bend forward. When the distemper is a little further advanced, it will be found that he cannot, without much difficulty and deliberation, direct either of his feet precisely to any exact point; and very soon after this both thighs and legs lose a good deal of their natural sensibility, and become perfectly useless for all the purposes of locomotion. When an adult is the patient, the progress of the distemper is much the same, but rather quicker. (p. 397–99.) * * * Without this erosive destruction of the bodies of the *vertebræ* there can be no curvature of the kind I am speaking of (curve forward); or, in other words, that erosion is the *sine quâ non* of this disease; and although there can be no true curve without caries, yet there is, and that not unfrequently, caries without curve. Also that the caries with curvature and useless limbs is most frequently of the cervical and dorsal *vertebræ;* the caries without curve, of the lumbal, though this is by no means constant or necessary. And that in the case of carious spine without curvature, it most frequently happens that internal abscess and collections of matter are formed, which matter makes its way outward, and appears in the hip, groin, or thigh; or being detained within the body, destroys the patient: the real and immediate cause of whose death is seldom known or even rightly guessed at, unless the dead body be examined. Further, that what are commonly called lumbal and psoas abscess, are not unfrequently produced in this manner, and therefore, when we use these terms, we should be understood to mean only a description of the course which such matter has pursued in its way outward, or the place where it makes its appearance externally. * * * And contrary to the general opinion, a caries of the spine is more frequently a cause than an effect of these abscesses." (pp. 472–74).

"After ulceration has gone to a certain extent," says LAWRENCE, "the spine bends forwards and becomes crooked; but the curvature which is thus produced essentially differs in its nature and direction from that of rickety affection of the spine; the curvature, in the present case, is always in the anterior direction, while in rachitis it is to one side." (p. 561.) BRODIE, however, observes, "this rule must not be admitted without some exceptions. A slight degree of lateral curvature is, in some instances, the consequence of caries, * * * by the bodies of the *vertebræ* having been destroyed on one side to a greater extent than on the other." (p. 311.)

With regard to the so-called palsy of the limbs in this disorder, POTT remarks:—"I have, in compliance with custom, called the disease a palsy; but it should be observed that, notwithstanding the lower limbs be rendered almost or totally useless, yet there are some essential circumstances in which this affection differs from a common nervous palsy; the legs and thighs are rendered unfit for all purposes of locomotion, and do also lose much of their natural sensibility: but, notwithstanding this, they have neither the flabby feel, nor have they that seeming looseness at the joints, nor that total incapacity of resistance, which allows the latter to be twisted in almost all directions; on the contrary, the joints have frequently a considerable degree of stiffness, particularly the ankles, by which stiffness the feet of children are generally pointed downwards, and they are prevented from setting them flat upon the ground." (p. 400.)

(2) BRODIE says:—"There is reason to believe that suppuration takes place at an earlier period in those cases in which the disease has its origin in the cancellous structure of the bones, than where it begins in the intervertebral cartilages. It is remarkable in some cases of this last description, to how great an extent ulceration will sometimes spread without the formation of abscess. I have known as many as three bodies of *vertebræ* completely destroyed, and the disease to have lasted many years, without matter having been formed. * * * We must not however conclude because no abscess has shown itself, that therefore no abscess exists. Frequently, in examinations after death, we find an abscess in connexion with carious *vertebræ*, which had never presented itself externally, but which evidently had existed for a considerable length of time. It is not uncommon to find caries of the *vertebræ* going on for two or three years before there are any certain indications of the existence of abscess. In one case in which the disease was in the *vertebræ* of the loins, an abscess presented itself in the groin at the end of eight years; and in another case, in which the disease was situated in the dorsal *vertebræ*, the interval was still longer, not less than sixteen years." (pp, 253–54).

BRODIE makes the following interesting observation on the disappearance and reappearance elsewhere of abscess, connected with carious spine: "I have known an abscess to have descended from the loins, and presented itself as a tumour in the groin.

Suddenly the tumour disappeared, and the patient has been led to entertain hopes of a speedy recovery. But these have been soon disappointed, in consequence of the discovery of a large collection of matter in the posterior part of the limb, behind the little trochanter of the thigh. In a case of this kind, in which I had the opportunity of examining the morbid appearances after death, I found that the abscess had taken the course of the common tendon of the *m. psoas magnus* and *iliacus internus*, to their insertion into the little trochanter, afterwards extending further backward, over the inferior edges of the *m. quadratus femoris*." (pp. 260, 61.)

(3) "The pain," says Brodie, "at first trifling, but afterwards more severe, is aggravated by any sudden motion of the spine; by percussion, or by a jar communicated to it in any other way; as by stamping on the ground, striking the foot accidentally against a stone, sneezing or coughing. In the advanced stage of the disease the pain is sometimes so severe, and so easily induced that the patient cannot bear the slightest movement. Yet in other cases there is sometimes no pain whatever in the spine, from the first access of the disease to its termination;" of which he mentions one remarkable case, "in which, judging from the degree of distortion, I was," says he, "satisfied that the bodies of not fewer than four or five of the dorsal *vertebræ* must have been destroyed, and that the disease had been going on for several years; yet he had never been known to complain of pain; and the first circumstance which attracted the attention of the parents was the angular projection of the spinous processes. This patient ultimately died; and, on examing the body after death, a large abscess was discovered lying on the surface of the carious *vertebræ*. In another case, in which the disease was supposed to have been cured, and the patient had not experienced pain for the two or three preceding years, on examining the appearances after death, I found the bodies of the *vertebræ* still in a state of caries, and an abscess, containing not less than half-a-pint of matter, connected with them." (p. 250.)

(4) "When the spine is incurvated forwards," observes Brodie, "in consequence of the destruction of the bodies of the dorsal *vertebræ*, the angular projection behind is more distinct than it ever is where the disease has attacked the vertebræ of the neck or loins. This is to be attributed to the greater length of the spinous processes in this part of the spine, and to the circumstance of their being, in the ordinary position of the parts, inclined more or less downwards. When the curvature is considerable the thorax becomes at the same time altered in figure. The diameter of the thorax, from above downwards, is rendered shorter, while the other diameters are increased; so that, while the figure of the chest is altered, there is but little difference in its actual capacity." (p. 257.)]

258. On examination after death, one or several of the bodies of the *vertebræ* are found destroyed by caries; the neighbouring *vertebræ* are eaten away and crushed together in front, so that the spinous processes project. A sac is formed of the *apparatus ligamentorum anticus*, cellular tissue, and so on, at the part where the *vertebræ* are destroyed, which contains a purulent cheesy mass, and from which openings lead into the external abscesses; in these sacs loose pieces of bone often lie. The bones are often converted into a spongy mass, which yields to the knife. Sometimes the interarticular cartilages especially are attacked, loosened up, and destroyed. Circumscribed deep holes are often found in the bodies of the *vertebræ*, filled with cheesy matter, and which I hold, with Delpech and others, to be tubercles (1). The area of the spinal canal is generally undiminished; sometimes, however, it is so, and there are traces of chronic inflammation, redness, thickening or softening of the spinal marrow, of its membranes, and of the nerves passing through them.

These examinations show that the disease occurs sometimes as a primary affection of the cartilages and ligaments, sometimes as a primary affection of the spongy substance of the bones themselves.

(1) Nichet (*a*) has endeavoured to prove this view of the disease by numerous examinations. On the other hand, Jæger (*b*) believes that these supposed tubercles are merely the modification of pus in the bony cells and beneath the periosteum, or inflamed and suppurating lymphatic glands on the spinal column.

(*a*) Gazette Médicale, 1835, Nos. 34, 35.

(*b*) Handwörterbuch, vol. i. p. 572.

[The pathological history of caries of the spine is thus briefly recapitulated by Brodie (*a*):—" In some instances it has its origin in that peculiar softened, and other wise altered condition of the bodies of the *vertebræ*, the appearance of which, in the bones belonging to other joints, and which seems to be connected with what is called a scrofulous state of constitution. In these cases ulceration may begin on any part of the surface, or even in the centre of the bone; but, in general, the first effects of it are perceptible when the intervertebral cartilage is connected with it, and in the intervertebral cartilage itself. In other cases, the *vertebræ* retain their natural texture and hardness, and the first indication of the disease is ulceration of one or more of the intervertebral cartilages, and of the surfaces of bone with which they are connected." (p. 243.) In reference to this point Key (*b*) observes:—" In scrofulous ulceration, the intervertebral substance is not unfrequently the part in which the degeneration begins; large masses of the fibro-cartilaginous structure degenerate and disappear, cavities containing pus are found in its substance, and the broken down fibres surrounding the walls of the abscess sufficiently attest the nature and progress of the action." (p. 140.) On the other hand, according to Lawrence, " this disease attacks only the bodies of the *vertebræ*, that is, it attacks that part of the bony structure of the spinal column, which is its most frequent seat in other parts of the skeleton, the cancellous or spongy part. The processes of the *vertebræ*, which are composed of firm or compact bony tissue, it does not attack." (p. 561.)

" There is still another order of cases," says Brodie; " but these are of more rare occurrence, in which the bodies of the vertebræ are affected with chronic inflammation, of which ulceration of the intervertebral cartilages is the consequence. In whichever of these ways the disease begins, if not checked in its progress, it proceeds to the destruction of the bodies of the *vertebræ* and intervertebral cartilages, leaving the posterior parts of the *vertebræ* unaffected by it; the necessary consequence of which is an incurvation of the spine forwards, and a projection of the spinous processes posteriorly At this period of the disease, the membranes of the spinal cord sometimes become affected with a chronic inflammation, which may extend even to the spinal cord itself; and when there is much incurvation, the latter not only becomes incurvated with it, but actually compressed in such a manner as cannot fail to interfere with the due performance of its functions.

" Suppuration sometimes takes place at a very early period; at other times, not until the disease has made considerable progress. The soft parts in the neighbourhood of the abscess become thickened and consolidated, forming a thick capsule, in which the abscess is sometimes retained for several successive years, but from which it ultimately makes its way to the surface, presenting itself in one or another situation, according to circumstances.

" In the advanced stage of the disease, new bone is often deposited in irregular masses on the surface of the bodies of the neighbouring *vertebræ*; and when recovery takes place, the carious surface of the *vertebra* above coming in contact with that of the *vertebra* below, they become united with each other, at first by soft substance, afterwards by bony anchylosis. The disposition to anchylosis is not the same under all circumstances; it is much less where the bones are affected by scrofula, than where they retain their natural texture and hardness; and this explains wherefore, in the former class of cases, a cure is effected with more difficulty than in the latter.

" Occasionally portions of the ulcerated or carious bone lose their vitality, and, having become detached, are found lying loose in the cavity of the abscess. It is scarcely necessary to add, that the existence of such exfoliations is, of itself, almost sufficient to preclude all chance of the patient's recovery." (p. 243-45.)]

259. The causes of this disease are scrofula, masturbation, rheumatism, gout, external violence. Where the complaint arises more from scrofula, it seems to originate as a primary disease of the bone; if, on the contrary, from gout, external injury, and so on, the cartilages and ligaments rather are attacked.

260. The stealthy progress of the disease must render the medical attendant very cautious in his diagnosis. Every thing depends upon attacking the disease at the onset. If once displacement have happened, the most fortunate result is that the swelling of the parts should diminish, and the pressure on the nerves springing from the spinal marrow be removed. If

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(*a*) Third edition. (*b*) Med.-Chir. Trans., vol. xix.

abscesses have already taken place, the prognosis is always very unfavourable; if left alone, symptoms of hectic consumption come on, when they burst, and the patient quickly sinks; or they contract to fistulous openings, discharge but little serous or purulent fluid, and the patient lives a long time in a miserable condition. Very commonly no treatment can prevent this melancholy result. The practitioner must be exceedingly careful with little children who do not yet walk, because in them the most important diagnostic character is deficient.

To determine more precisely the seat of the disease, various distinguishing signs have been given. According to COPELAND, great sensibility of the diseased *vertebræ* on external pressure, and on rubbing down with a sponge dipped in hot water. According to WENZEL, the pain should be increased by pressure with both hands upon the shoulders acting on the parts beneath, or on the application of volatile irritants, especially caustic ammonia. According to STIEBEL, the situation of the disease is more distinctly shown in a warm bath with potash. But all these methods of proof give no decided result; and I have observed, on the contrary, many cases in which, as the result proved, no spondylarthrocace was present, although it had been indicated by these tests. (MELKER) (*a*). I consider especially important in the diagnosis of this disease, the peculiar carriage of the body which often precedes, but always accompanies, weakness of the lower limbs. The knees of the patient in standing are somewhat bent, and the head inclined backwards, so that the neck sinks between the shoulders; in walking, the arms are bent at the elbow-joint and hold to the trunk; the patient always seeks after a resting-place with his hands, places them upon the hips, and in stooping, upon the thighs; in bed he can turn only with difficulty, and very commonly sweats at night. This disease is clearly distinguished from the curvature depending on rickets or improper action of the muscles, though it may be connected with them. In adults the disease is more dangerous than in children.

In children whose head and the upper part of whose body are very heavy, there often appears, when they first begin to walk, a bending of the spine and a weakness of the legs, so that they draw them back at every attempt to place themselves erect. This condition, which depends on weakness of the muscles of the back and the weight of the head, may be, as I have frequently seen, mistaken for spondylarthrocace. Careful observation of the condition of the body, examination of the spine in the prone position, and the projecting curve which the spine forms in sitting and standing, easily determine the diagnosis.

[The distinction between curvature of the spine from caries, and that from rickets, is very well marked, and the two can rarely be mistaken. In caries, the spine is always bent forwards, and, having usually a sharp abrupt form, is called the *angular* curvature, or, from its direction, the *anterior* curvature; and there is rarely, if ever, more than one curvature of this kind. But in rickets, as LAWRENCE well observes, "you *never* find a *single* turn only in the vertebral column. If the *vertebræ* were weakened in the loins, so that the column would bend towards the right side, that must necessarily be followed by a bending of the spine higher up towards the left side, in order to preserve the line of gravity of the body. If the vertebral column were to bend altogether towards the right side, the weight of the head and upper parts of the body could not be supported at all. Thus one curvature in the bones of the spine necessarily induces a deviation in another part. You sometimes find that you have two, three, or more of these curves; the effect of one compensates for the other; so that, however great the curvatures may be, the weight of the upper part of the body still falls upon the pelvis and lower extremities. The curvature, which takes place in consequence of this condition of the spinal column, is on one side, and is commonly called the *lateral* curvature of the spine, from the circumstance that the incurvations are all of them towards the side; so that sometimes the spine exhibits, under these circumstances, very much the form of the letter S,

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(*a*) Diss. de Medullæ Spinalis Erethismo. Francof., 1838.

instead of the natural upright appearance. This is an affection which takes place in young persons. It occurs during the period that the body is growing, and at the time of puberty; when the frame acquires its full strength and solidity, the bones become firm and strong, they lose their softened or rickety state; they, however, are not natural in their form, and consequently the figure remains permanently deformed." (pp. 533, 34.) In rare cases, however, curvature forwards of the spine also occurs from "a weak condition of the muscles, or a rickety affection of the bones," and upon such examples BRODIE observes:—"In general, in such cases the curvature occupies the whole spine, which assumes the form of the segment of a circle. At other times, however, it occupies only a portion of the spine, usually that which is formed by the superior and inferior dorsal *vertebræ;* as I have ascertained, not only by examinations during life, but by dissection after death. Here the curvature is always gradual; never angular, and thus it may be distinguished from the curvature as arising from caries. Nevertheless, I am satisfied that these different kinds of curvature, arising from different causes, have frequently been confounded with each other; and that some of the cases which have been published as examples of caries of the spine, and in which it may, at first, be a matter of surprise that so complete and so speedy a cure has been effected, have in reality been cases of an entirely different malady." (p. 253.) BRODIE refers to some excellent observations of HENRY EARLE (*a*) on this subject.

BRODIE states that, "as the disease advances, the patient, in some instances, complains of pains, which are referred to one groin and hip, such as may lead to the suspicion that there is disease in the hip-joint; and, in fact, a very common error (and one into which even Surgeons of great experience are liable to fall) is to regard the symptoms of caries of the middle and inferior dorsal vertebræ as indicating incipient caries of the hip." (p. 285.)]

261. The *treatment* must be conducted in reference to the previous rules. At the onset, according to the constitution of the patient, leeches, cupping, and internal remedies adapted to the general cause of the disease, must be employed. In traumatic inflammation of the spine, cold applications, with suitable antiphlogistic treatment, must be used from the beginning. When the inflammatory symptoms have been, in this way, diminished, rubbing in mercurial ointment and (in scrofulous persons) iodine ointment, are exceedingly serviceable; but the most important are continual derivations, most conveniently made by several issues of caustic placed on both sides of the diseased part of the spine (1), or by several suitable long streaks with the actual cautery. If improvement take place, and the weakness of the lower limbs cease, the issues must nevertheless be kept open for a long time. In sluggishness of the bowels, attention must be paid to regulating the motions; in failing of the powers, they must be supported by bark and proper dietetic treatment; and, in retention of urine from weakness of the bladder, care must be taken to empty it with the catheter. An attempt to remove the deformity of the spine by machinery, and the like, shows an entire misunderstanding of the disease, but is necessary, both on account of resting the diseased part, as well as to prevent further sinking down of the spinal column, to preserve strictly the horizontal position on the back or belly during the whole treatment (2). When abscesses are formed, they must, if not very large, be left alone; if the caries of the *vertebræ* be brought to heal by the application of powerful derivatives, these abscesses often disperse of themselves by the pus in them being absorbed and their walls contracting to a cord; in rare cases, the pus contained in them may be changed into a mass like adipocere. (DUPUYTREN) (*b*). If these abscesses be very large and threaten to break, they must be opened by a single thrust of a lancet, emptied of the pus by equable pressure, without permitting the entrance of the air, and the opening carefully closed with sticking plaster. The edges of the opening soon unite, and the emptying of the swelling, if the

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(*a*) Edinburgh Medical Journal, Jan. 1815.

(*b*) Leçons Orales de Clinique Chirurgicale, Paris, 1832, p. 138.

re-collection of the pus should make it necessary, is to be repeated in the same way (3).

Compare B. St. Hilaire (a) upon the symptomatic abscesses which accompany caries of the *vertebræ*, and upon the possibility of being able to determine anatomically, from the external seat of these depositions of pus, the diseased *vertebræ*.

[(1) In regard to the fact "some cases occur in which the caustic issues seem to be productive of little or no benefit," Brodie observes, "probably it is with diseases of the vertebral as it is with those of the other joints, and issues may be of little or no efficacy where the ulceration of the cartilages is preceded by a scrofulous disease of the cancellous structure of the bones; and they may be productive of real benefit where it takes place under other circumstances. Nor, if my observations on the subject be well founded, is this to be regarded as a merely theoretical opinion. I have repeatedly known the greatest relief to follow the establishment of issues where the patient has suffered severe pain in the situation of the carious *vertebræ*, presenting, at the same time, no distinct indications of a scrofulous diathesis; while in young persons, with fair complexion and dilated pupils, in whom the disease has proceeded with little or no pain, they have appeared to be either inefficacious or actually injurious. It appears to me, also, that, in caries of the spine, as well as in that of other joints, issues are to be employed only in the early stages of the disease with a view to prevent suppuration, and that they are of no service after abscess has actually formed." (p. 268.) With great deference to so high authority as Brodie, I cannot agree to the opinion last mentioned, as I am quite sure that I have several times seen issues extremely useful after suppuration has taken place, so that, under their employment, the irritation which has given rise to the abscess has subsided, and the disease cured.

(2) "The mode in which the disease becomes cured is," says Astley Cooper, "by the upper portions of the *vertebræ* falling on the lower, and, in this way, anchylosing. This must be your object in the treatment of this disease. You should keep the spine of the child as much as possible at rest; with this view he should be constantly in the recumbent posture, so that the *vertebræ* may be suffered to fall into contact, and, by coalescing, effect anchylosis. If you attempt to keep the spine straight, you will defeat the object of nature; do not keep the patient in a direct straight line, but rather assist nature in producing the union of the *vertebræ*. * * * If the child cannot be kept at rest, if the parents are unable or refuse to observe these instructions, the next best treatment will be to apply one of Callow's backs, which is worn upon the spine, and fixed round the pelvis and shoulders. As to avoiding deformity, that is out of the question; in all these cases deformity is inevitable: whatever you do, this cannot be prevented." (p. 459.)

"The incurvation forwards," says Lawrence, "is necessary to fill up the deficiency produced by the ulcerative absorption. The bodies of those *vertebræ* which have been partially destroyed cannot be restored, for, as the spine bends forwards, the upper part comes in contact with the inferior, and an imperfect kind of anchylosis ensues; some additional bony matter is thrown out, which attaches the two ends of the chasm, consolidates them together, as we might say, gives a sufficient degree of solidity to the parts, and enables them to sustain the weight of the body above, and to admit of the ordinary motions of the spine. The curvature, therefore, here, is really only a necessary part of the curative process. The disease cannot be brought to an end with preservation of the straight figure of the spine where it has gone to a certain extent; nor when the curvature has once taken place, will any attempt to restore it succeed." (p. 562.)

"From the first moment," says Brodie, "in which the nature of the case is clearly indicated, the patient should abandon his usual habits and be confined altogether to his bed or couch. In some instances in which severe pain in the *vertebræ* is among the early symptoms of the disease, the patient will submit to the privations which are thus imposed upon him with sufficient willingness, while in others nothing but a candid exposition of the ill consequences which may otherwise arise will overcome his reluctance to do so. The invalid bedstead, contrived by Mr. Earle, will, in ordinary cases, afford the most convenient means of conducting this part of the treatment. The use of it is attended with this great advantage, that the patient may be laid on his back, and the trunk and thighs may be, from time to time, and within moderate limits, elevated or depressed, so that their relative position may be varied without the smallest movement being communicated to the carious *vertebræ*. Where, however, the disease has been going on for a long time, and there exists already a considerable angular curvature of the spine, it is desirable that the patient should recline on his side rather than on his back; or if he finds this in any way inconvenient or disagreeable, he should lie, not on an absolutely flat surface, but supported by cushions and pillows, so that the position in which he is placed may have no tendency to restore the spine to its original figure. In the management of these cases it is important that we should always bear in mind, that without undue interference on the part of the surgeon, the carious or ulcerated surface of the *vertebra* above will come in contact with that of the *vertebra* below; and that it is to the union which takes place between them under these circumstances at first by soft substance and afterwards by bony anchylosis, that we are to look for the patient's recovery. In artificial straightening or elongating the incurvated spine, we necessarily disturb this curative process, and therefore all attempts to do so, whether by machinery or by laying the patient in the supine posture on a horizontal board, are to be scrupulously avoided (pp. 265, 66).

(a) Journal Hebdomadaire, 1834, Décembre.

(3) Abscesses connected with diseases of the spine so commonly terminate in psoas or lumbar abscess, that what has been already mentioned in relation to those disorders sufficiently applies here, and, therefore, does not need repetition.—J. F. S.]

262. In a similar way to that in the dorsal and lumbar *vertebræ* does the diseased condition come on in the cervical *vertebræ*, and most commonly between the head and the first, or the first and second *vertebræ*, and in the *synchondrosis sacro-iliaca.* In the former case the disease commences with a painful affection of the neck, which is increased at night, in damp weather, in swallowing large morsels, and even on deep inspiration (1), but may be diminished, or often apparently removed, by volatile rubbing and blistering. The uneasiness, however, soon returns; bending the head towards the shoulders is painful, and a drawing pain extends from the larynx into the nape, and even to the shoulder-blade. No change is to be perceived in the nape; but pressure with the finger at the union of the first and second *vertebræ* produces severe pain. Swallowing and breathing are painful, the voice is hoarse, the pain is concentrated at the back of the head, and on every one of its movements is intolerable. The head at last drops on the shoulder opposite the disease, in which position the patient keeps it fixed. Symptoms of general illness in different degrees are present. After a short seeming improvement the pain returns more severely, and the patient has the sensation of the head being enclosed with a cord. It sinks at last in the opposite direction, and the patient endeavours to keep in the same posture on account of the severe pain. Noise in the ears, deafness, giddiness, convulsions, partial paralysis, especially of the upper limbs, loss of voice, all the symptoms of hectic fever occur, and death often suddenly takes place. Fistulous openings in the neck are rare (2). Generally there is not any external diseased indication in the neck, except that the patient cannot bear the least pressure.

[(1) Brodie says this pain "is not unfrequently mistaken for the muscular pains and stiffness connected with what is commonly called a stiffness from cold. The pain gradually increases; and, according to my experience, is more liable to be severe than when the seat of the disease is in the lower part of the spine. * * * At an early period the patient frequently complains of pains in the arms and shoulders. After some time these pains subside, but they are followed by complete paralysis of the upper extremities; while the muscles which derive their nervous influence from the spinal cord below the neck, remain subject to the will. In a still more advanced stage of the disease, the paralysis extends to the muscles of the trunk, and of the lower extremities. Then there are pains in the abdomen, which becomes distended and tympanitic; the bowels being, at the same time, obstinately costive. In all cases there is pain in the occiput and temples; which is, however, most severe, when the disease is situated in the two or three superior *vertebræ*." (p. 255.) Astley Cooper says, that "when the disease is in the neck, the head is the only part of the body, except the vital organs, which retains its power; volition is lost in all the parts of the body below the seat of the disease, and the patient is reduced to the most abject state of helplessness." (p. 458.)

(2) Abscess connected with diseased cervical *vertebræ*," Brodie observes, "usually presents itself among the muscles on the side of the neck. Occasionally it makes its way forward, forming a tumour, and afterwards breaking, in the pharynx. I have seen one

instance," says he, "in which the abscess penetrated into the *theca vertebralis* and the whole spinal cord, from its origin to its termination, was bathed in pus." (p. 255.)]

263. Dissection shows the periosteum and joint-ligaments of the atlas and axis destroyed, carious destruction on the occipital condyles on the atlas, and on the odontoid process of the axis; suppuration among the neighbouring soft parts; sometimes blood poured out from the diseased vertebral artery; pus in the cavity of the chest, or diseased changes of the membranes and substance of the spinal marrow and brain.

264. In the *spondylarthrocace sacralis*, if the disease first appear as inflammation and ulceration of the *synchondrosis sacro-iliaca*, occurring after mechanical violence on the rump-bone, after raising a heavy weight, after difficult delivery, or after previous rheumatic affection, there is a fixed pain near the rump-bone which is very severe on standing upright: the patient, therefore, usually lies, or sits as little as possible; his walk is very difficult, limping, painful; the position of the back stiff, which is lessened in moving; the pain frequently extends through the buttock, in the course of the ischiatic nerve to the foot or towards the groin. Pressure upon the *synchondrosis sacra-iliaca*, and upon the rump-bone, is painful; frequently the region of the affected joint is swollen. The extremity of the diseased side is often stiffened, and cannot be moved without the most severe pain. The inflammation is often great, especially after child-birth and severe injury, and is accompanied with considerable fever. I have observed this condition in both joints of the rump-bone at the same time, after difficult labour, in which walking was in the highest degree painful, and resembled an alternate dropping from one foot to the other. Palsy of the lower limbs and of the rectum is rarely observed. Abscesses may appear either externally on the synchondrosis, or in the neighbourhood of the rectum.

265. As to the etiology and treatment of this disease, all applies which has been hitherto mentioned.

The same conditions which have been here described in various joints, may also arise, in a similar manner, in all the other joints,—those of the foot, hand, and elbow, and require the same treatment.

SECOND DIVISION.

DISEASES WHICH RESULT FROM THE DISTURBANCE OF PHYSICAL CONTINUITY.

I.—SOLUTION OF CONTINUITY.

A.—RECENT SOLUTION OF CONTINUITY.

a.—Of Wounds.

First Chapter.—OF WOUNDS IN GENERAL.

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Jones, Wharton, Report on the changes in the Blood in Inflammation, and on the nature of the Healing Process; in British and Foreign Medical Review, vol. xviii. July, 1844.

266. Every sudden division of organic parts produced by mechanical violence, and at first accompanied with more or less bleeding, is called a *Wound* (*Vulnus*, Lat.; *Wunde*, Germ.; *Plaie*, Fr.).

267. Wounds are differently divided, according to the instruments by which they have been produced, according to the condition of the wounded part, according to their form and direction, and according to their seat.

268. Wounds are distinguished according to the instruments by which they are caused; thus *Incised* and *Punctured Wounds* (*Schnitt*, *Hieb*) (1), *und Stichwunden*, Germ.; *Plaies par instrumens tranchans*, *contondans*,

et piquans, Fr.) when the division is made by sharp, cutting, or penetrating instruments; *Contused* or *Lacerated Wounds* (*gequetschte und gerissene Wunden*, Germ.; *Plaies contuses et déchirées*, Fr.) when the parts are divided by blunt instruments, or when they have suffered severe tearing and stretching before giving way.

Every division by cut or stab is accompanied with some contusion of the part; but the finer the edge and point of the wounding instrument are, and the more they have acted by being drawn along, the less is the amount of contusion; therefore cut and thrust wounds are at the same time contused, if the instrument producing them have not the proper degree of thinness and sharpness.

[(1) German surgeons make a distinction of incised wounds which we do not commonly use. The *Schnittwunde* is made by drawing a cutting instrument along the part, which is thus divided; our ordinary expression, a *cut*, or the phrase, *the part has been cut*, is equivalent to it. The term *Hiebwunde* implies a wound made by an axe or sabre struck into or through a part, and answers to our word, a *chop*, or *the part has been chopped*. The cut (*Schnittwunde*) implies the division of a part with the least possible injury. The chop (*Hiebwunde*) may, on the one hand, be effected with as little injury as the cut; but, on the other, it may be accompanied with slight bruising, but sufficient, strictly, to put it among the most simple kind of contused wounds.—J. F. S.]

269. According to the condition of the divided parts, wounds are distinguished as *simple* and *complicated*. *Simple* wounds are those in which the parts suffer no other injury beyond their division, and require only the junction of the edges for their union. *Complicated* wounds are those in which there is something wrong in the wounded parts, or in the constitution, which requires modifications of the treatment of simple wounds. The complications are very various, as depending on many accidental circumstances; viz., bruising, bad form of wound, bleeding, discharge, or effusion of various fluids, loss of substance, the presence of foreign bodies in the wound, which act either merely mechanically, or have a special deleterious influence on the whole organism, *poisoned wounds*. Wounds may, in their course, be accompanied with active fever, nervous symptoms, and so on.

270. According to the various direction and depth of the division, they are distinguished into *longitudinal*, *transverse*, *oblique*, *superficial*, *deep*, *penetrating*, *and flapped wounds*.

According to the difference of the wounded parts, wounds are generally divided into those of the skin and cellular tissue, of the muscles, of the tendons, of the vessels, of the nerves, of the *viscera* contained in cavities, of the bones; and, according to situation, wounds of the head, neck, breast, belly, limbs, and so on.

271. The symptoms of wounds are pain, bleeding, separation or gaping of the edges of the wound, inflammation, fever, and nervous symptoms.

The *pain* at first depends upon the injury of the nerves, and afterwards on inflammation. It varies according to the kind of division, and the sensibility of the part and person.

The *bleeding* is more or less abundant according to the size and number of the divided vessels, and is always greater in cut than in bruised or torn wounds.

The *gaping of the edges of the wound* at the very first depends on the entrance of the wounding instrument, but especially on the elasticity and contractility of the parts, and is greater the more the parts were stretched at the moment when the wound was made, or the more they were irritated during, or after, the wound.

The division itself, and the admission of the air to the exposed parts, excite a general reaction, and increased flow of blood,—*inflammation*, hence swelling, redness, dryness of the wound, and increased pain. According to the severity of the wound, the constitution of the patient, and the sensibility of the wounded part, is the reaction more or less great; and in proportion to these circumstances does the *Sympathetic Fever* (*Febris traumatica, Febris inflammatoria secundaria*, Lat.; *Wundfieber*, Germ.) come on in direct relation to the inflammation of the wound. The inflammation either only attains the degree of adhesive inflammation, and passes on, if the wounded parts be kept in close contact, to resolution and adhesion; or, if the inflammation be greater, or if the parts cannot be united, it proceeds to suppuration and, under particular circumstances, even to mortification. The inflammation may have either a simple, erethetic, or torpid character, according to the difference of constitution and other circumstances. Just so does the nature of the fever differ according to the constitution of the patient, according to the prevailing character of the disease, and so on; and it may even show an intermitting type.

The *nervous symptoms* accompanying wounds are, severe pain, which is not proportioned to the inflammation in the wound, restlessness, loss of sleep, *delirium*, convulsions, *trismus*, *tetanus*, and so on. The causes of these symptoms are morbidly increased sensibility of the whole body or of the wounded part, wounds of nerves, aponeuroses, and tendinous parts, tying of nerves with vessels, foreign bodies or accumulated and bad pus in the wound, foul, damp, and cold air, sudden chills, great loss of blood, sympathetic irritation, especially in the bowels, and so on.

272. The cure of wounds is effected in two ways:—

HUNTER, MECKEL (*a*), and others, speak of *three* kinds of union of divided parts; viz., by the *quick union*, by *adhesion*, and by *granulation*. In the *quick union* blood is poured out between the two divided surfaces; this coagulates, separates into its constituent parts, applies itself to the divided surfaces, and from this moment the union commences. The blood dries on the surface, forming a scab which covers the surface of the wound; and from the blood remaining beneath it the new parts are formed, the red parts being absorbed, and the coagulable lymph, from which the organs are formed, remaining. This union by coagulable fluid is effected *without any increased activity of the blood-vessels*, as the connecting medium is here poured out with the blood. If this, however, do not take place, in consequence of the blood, by contact with the external air, having either lost its vitality, or, at least, its capability of becoming organised, and, if the separation have existed so long that the open mouths of the divided vessels are closed, then *inflammation* takes place; coagulable lymph oozes either from the half-open mouths of the divided vessels or out of the cellular tissue, coagulates, and in it are developed the connecting vessels. The quick union takes place even when the parts, on account of the blood poured out between them, do not directly touch; in which case the superfluous blood is absorbed, the swelling diminishes, and the new vessels spread from the coagulable lymph and surrounding parts into the unabsorbed blood, of which the red part at last disappears. In every cure by the first union there is always, at first, a layer of coagulated lymph upon each divided surface, and between these two sometimes a layer of blood, forming a middle layer. The union of bone, according to MECKEL, takes place in the same manner; the out-poured blood being, in this case also, the base of the union, the red part is absorbed, and the remainder converted into gelatin. MECKEL, however, adds, that the vessels also themselves seem to pour out the direct material of union and reparation, their tonicity being altered.

This view of the process of *quick union* does not, however, agree with experience, which shows that the interposition of a layer of blood between the edges of a wound prevents its quick union; and when, as sometimes happens, a thin layer of blood does remain, by which adhesion is not completely prevented, the union does not take place before the blood has been absorbed, and till the edges of such wounds in which blood is contained are also covered with a layer of coagulable lymph. The blood between the edges of a wound never makes anything but an apparent union, which endures, however, but for a short space of time. Often, indeed, is the blood between the edges of a wound found completely surrounded

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(*a*) Handbuch der pathologischen Anatomie, vol. ii. part ii. p. 47.

by a layer of coagulable lymph, poured out during inflammation, and often very difficult to be distinguished from it; but the union does not take place until the blood is expelled, or removed by absorption. That the coagulable lymph, after the red parts of the blood have been absorbed, effects the union, without *increased vascular action*, is quite improbable. The coagulating fluid which effects the union of wounds is not merely *lymph poured out* in the state in which it circulates, but it is the product of inflammation, which, to a certain extent, accompanies the reunion in every stage of its course. That the blood has nothing to do with the union is shown by the appearances which are observed in extravasation of blood into cavities, especially of the belly. The same objection applies also to the union of broken bones, *without increased vascular action*, which has been put forward by DZONDI (*a*).

[The opinion above stated as to union by the first intention, a term which, according to JOHN THOMSON, was first employed by GALEN, is that of JOHN HUNTER, and the objections to it are substantially those of THOMSON. It may also be inferred, though not so distinctly stated, that ASTLEY COOPER does not believe in the union by the first intention, or more correctly, by blood. In speaking of wounds, he (*b*) directs "the coagulated blood to be completely sponged away from the surface and edges of the wound, the edges to be brought together, and a strip of lint or linen moistened with the blood, to be placed on the part in the direction of the wound, when the blood by coagulating glues the *edges* together in the most efficient and natural manner; adhesive plaster is to be applied over the lint, with spaces between to allow of the escape of the blood or serum;" and then immediately he adds:—"In a few hours inflammation arises, and *fibrin becomes effused upon the surfaces and edges* of the wound, by which they become cemented." (pp. 150, 51.)

Upon the same subject TRAVERS makes the following pertinent observations:—"Is the blood," asks he, "when effused from wounded surfaces, a medium of organised adhesion? or capable of becoming so? I answer in the negative: the question turns upon a delusion. If the wound be so small as that the effusion of blood is restrained by the adaptation of its sides, whether naturally falling together, or artificially compressed, the separation of its colouring matter is shown by a plentiful oozing of sanies at its mouth and the formation of a crust. If, on the other hand, the wound would be of such form or size as to present co-aptation, or be attended with loss of substance, the coagulum of coloured blood being in proportion, acts as a foreign body, and must be dislodged prior to healing. Hence the difference in the time, and often in the mode of healing, of a small gaping wound left to itself, or a wound with loss of substance, and that of a larger wound, whose sides are immediately brought and maintained in contact. Thus the agglutination of the lips of a small wound, by a thin layer of blood, a merely temporary expedient, is no bar to the union, but the contrary, both in respect of hæmorrhage and union, though never forming the permanent bond. In truth, no wound of any dimensions, however favourably situated for the adhesive process, and rapidly united, has not, when fresh, a layer or pellicle of blood coating its surface; not admitting of removal by abstersion, but insusceptible also of healthy organization. The separation and deposit of fibrine takes place distinctly, and after an interval. This is marked even in cases of simple division of the solid, but in loss of substance occupies many days; being step by step, and only just a-head, or in advance of vascularization." (pp. 81, 2.) "The fibrine effused in a state of solution in the *liquor sanguinis*, only becomes susceptible of organization, *i. e.* capable of permanent incorporation with the living solid, when separated from the other constituents of the blood. It is incapable of organization if effused in combination with the blood-corpuscles, as in extravasation or hæmorrhage. This observation is not contradicted by the appearance of vessels in a coagulum, which serves as a spurious plasma or bed for the reception of the blood-corpuscle, and the shootings of the pseudo-capillaries in an arborescent form; and which, whether confined by cellular membrane or a layer of sponge, admits of no further advance towards vital organization, or the attainment of the self-preserving and adapting principle." (p. 162.)

1. If the wound be simple and the parts not bruised, the edges brought into close contact, and the inflammation not proceeding so far as suppuration, but only to the secretion of albuminous lymphatic fluid, the edges of the wound become connected together, and, as the vessels shoot in from either side, the union is perfected. This kind of healing is called the *Quick Union* (1) (*Reunio per primam intentionem*, Lat.; *Schnelle Vereinigung*, Germ.; *Réunion par première intention*, Fr.)

(*a*) Lehrbuch der Chirurgie. (*b*) Surgical Lectures edited by TYRRELL, vol. i.

[(1) The reader will probably be struck with the peculiarity (to us) of the designation, "quick union," applied to the immediate and more simple mode by which divided animal structures unite; but it is the expression used by the author, and as his translator I have no right to vary it, merely because it is a phrase to which our ears are not accustomed. It is also to be noticed that CHELIUS employs the expression "quick union" as synonymous with "union by the first intention," as may be seen in the preceding note, when he enumerates the kinds of union mentioned by HUNTER and MECKEL. But this is incorrect, as it is evident by the term "quick union" he means the union by adhesion of HUNTER and other English surgeons, and not "union by the first intention," which although enumerated by HUNTER as one form of union, has long since been discarded in this country.—J. F. S.

The adhesive inflammation, in connexion with wounds, is thus described by JOHN HUNTER:—"It first throws out the blood, as if the intention was to unite the parts again. The newly cut or torn ends of the vessels, however, soon contract and close up, and then the discharge is not blood, but a serum, with the coagulating part of the blood, similar to that which is produced by the adhesive state of inflammation, so that they go through the two first processes of union; therefore the use of the adhesive inflammation does not appear so evidently in these cases as in spontaneous inflammation." (p. 368.)

Although the account of adhesive inflammation given by ASTLEY COOPER is not so complete as that given by modern writers, who have had the opportunity of employing the microscope, yet it is well worthy of attention; and it is to be borne in mind, that although the publication of his opinions are only comparatively of modern date, yet are they the same which he had for years taught in his class-room. "When an incision is made," says he, "into a part which has been affected by adhesive inflammation, viz., the cellular membrane, a quantity of serum is found effused around the inflamed part, and in the part itself a yellow and semi-transparent substance having the appearance of jelly, though different in its nature. (p. 97.) When adhesive matter has been formed, blood-vessels soon enter it, and in a short time it becomes organised; the *vasa vasorum* are elongated by the force of circulation, and enter the newly formed substance, sending out minute ramifications. On cutting into adhesive matter within twenty-four hours after it has been deposited, small bloody spots may be seen, marking the future situation of the vessels which nourish it; but it is not till ten days after it has been formed, that any considerable portion of adhesive matter becomes entirely organised; for if injected, you will not completely succeed through every part of the newly formed substance, until ten days after the injury, and not even so soon in certain structures. When vessels elongate, they have not the character of arteries in general; they take a serpentine and tortuous course. It has been thought that the new vessels originated in the effused substance; but they are formed by the elongation of the *vasa vasorum* of the surrounding arteries, which become dilated, lengthened, and serpentine; and the degree of vascularity will be in proportion to that of the part subjected to the adhesive process." (pp. 99, 100.)

The process of union by adhesion, according to the modern views generally held, is thus briefly described by BENNETT (*b*):—

"When an incision has been made in the skin, blood flows from the divided capillaries, until they are obstructed partly by their own contractility, and partly by the coagulated blood blocking up the cut extremities. The early phenomena of inflammation now manifest themselves, the capillaries become distended and engorged with blood, and at length exudation or the essential phenomenon takes place. After a time, which varies according as the blood more or less abounds in fibrin, the cut surface is glazed as it is called, that is, the exudation has coagulated on the surface, and is transformed into plastic lymph. If now the parts are accurately brought together, little more exudation takes place. Cells are formed which rapidly pass into a fibrous formation and healing or union by the first intention is the result." (p. 61.)

"The exuded matter," says WHARTON JONES (*c*), "from being at first serous, comes at last to contain a greater or less quantity of fibrine or fibriniform matter (oxyprotein), and in this state is a clear viscid fluid, usually called lymph. As this fluid is the same as the plasma of the blood, it of course has the same properties, physical and chemical. It may remain fluid, or coagulate; and having coagulated, the serum may or may not be separated. In the latter case, the exuded matter is gelatiniform; in the former, the coagulum is consistent or diffluent, according to the proportion of fibrine or oxyprotein contained in the exuded matter. The serum which is separated, may either be soon removed by absorption or collect. Examined microscopically, the recently exuded matter appears

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(*a*) Lehrbuch der Chirurgie, § 209.
(*b*) Treatise on Inflammation.
(*c*) Quoted at the head of the division.

quite amorphous, without any trace of organization, except that, when coagulated, it may be more or less indistinctly fibrous and covered with oil globules, appearances which, however, have nothing in common with the organization which afterwards ensues. The corpuscles which the fibrinous matter, very soon after exudation, is found to contain, have been alleged to be the colourless corpuscles of the blood which have escaped from the vessels; but this is not the case. As already said, none of the corpuscles of the blood pass out along with the exuded fluid as long as the vessels are entire. The corpuscles in exuded matter are new formations, developed after exudation, developed in it, in fact, as in a blastema." (p. 271.)

Of "*healing by the first intention or adhesion*" Jones says:—"In this case the matter exuded on the cut surfaces becomes forthwith, and all of it converted into tissues—cellular tissue and capillaries—by which the divided parts are reunited. An epithelium or epidermis is then formed on the surface in the ordinary way, and cicatrization is completed." (p. 280.) The formation of *the cellular tissue* is thus described by the same writer:—"There are formed numerous round nuclei (exudation corpuscles) in the cytoblastema, which elongate, becoming slender and arrange themselves one after another in rows. At the same time the cytoblastema is resolved into flat fibres from 1-5600th to 1-3700th of an inch broad. On the surface of these flat fibres lie the nuclei which become partly absorbed, partly coalesce to form nucleus and elastic fibres. The broad fibres either remain at this stage of development, in this state resembling the fibres of the middle coat of the arteries, or they split into finer fibrils, begin to curl, and become true cellular tissue. Mr. Gulliver, appealing to the fibrous structure which fibrin presents immediately on coagulation, has been led to express doubts as to the universality of the application of Schwann's doctrine. Mr. Gulliver is quite correct when he says, that he could never see any satisfactory evidence that the fibrils of fibrin are changed cells. Direct observation clearly shows that the fibrin is at once formed into fibres in the act of coagulating. But Mr. Gulliver is not correct in adducing the fibrous structure of fibrin as an argument against the development of fibres from cells." (p. 273.) The development of *new vessels*, in fact, is in itself a process of organization which presupposes the development or organization of other tissues. New vessels are not formed for the purpose of "vitalizing" "effusions of the organizable materials of the blood," for such effusions are already vitalized. It is from such effusions that the new blood-vessels themselves are developed, and that along with the development or organization of other tissues, such as the cellular. The blood-vessels are formed in order to fetch and carry away the materials concerned in the nutrition and further development of these tissues. All the best observations on the development of new vessels hitherto, tend to the establishment of the proposition, that it takes place in this way. At the same time that the new cellular or other tissue is being developed, cells are formed, which coalesce with and open into each other, and form net-works of capillary vessels, at first quite separate from and independent of the old vessels of the part, with which they only afterwards enter into communication, as Mr. Hunter supposed." (pp. 274, 275.)

Lawrence observes:—"An objection has been taken to the employment of the term *inflammation*, in reference to that process by which a recent wound is united; for, in fact, under favourable circumstances, we find the union will take place without the occurrence of any great vascular disturbance of the part. Often you will not be able to notice any swelling, redness, heat, or pain; not any of those circumstances which are considered necessary to establish the presence of inflammation. In fact, if those circumstances occur, that is, if inflammation takes place in the part, recognisable by the circumstances which we ordinarily observe as characterizing it, the union by adhesion is disturbed and affected. The occurrence, therefore, of inflammation, in its obvious and distinctly recognisable character, interferes with and prevents the accomplishment of adhesion." (p. 522.)

The following is the brief review, by Bennett, of the several opinions now held in regard to the formation of new vessels:—

"It is now well understood that the appearance of vessels in colourless tissues, as in the *conjunctiva*, is not owing to their being newly formed, but to the over-distension of those which were previously too transparent to be visible. In the exudation poured out on serous membranes or on granulating surfaces, vessels which had no previous existence are produced, and the manner in which this takes place is not yet definitely determined. Two views have been advanced: 1st, That new vessels are formed in connexion with the old ones, by the escape of a blood-corpuscle, hollowing out for itself a channel in the exudation, which subsequently becomes a vessel; 2nd, that the new vessel arises independently of the old one, from minute points, which become enlarged, and afterwards connect themselves with the old ones. This opinion, which was advanced by **John Hunter**, is most consistent with the researches of **Schwann**, and the known mode of development of vessels in the embryo. **Doellinger** and **Kaltenbrenner** consider that new vessels may be formed in both stages. Their mode of arrangement in lymph have been shown by the injections of **Pockels**, and in granulations by those of **Liston**. The difficulty of the inquiry consists in ascertaining how the vascular walls are formed previous to that period when an injection can be thrown into them. The late observations of Mr. **Travers**, on the injured web of the frog's foot, seem to confirm the first view above mentioned, whereas those of **Hasse**, **Henle**, **Skoda**, and **Kolletscha**, on the new vessels of lymph in man, tend to the conclusion that isolated extravasations of blood channel for themselves passages in the coagulated exudation, which subsequently become vessels, and unite with those previously existing. These isolated and star-shaped collections of blood I have frequently seen in recently effused lymph, but hitherto have never been able to satisfy myself that they constitute the first formation of new vessels. The whole subject demands renewed investigation." (pp. 62, 3).]

2. But if the wound do not at once unite, there exudes, for the first few days, from the whole surface a reddish serous fluid, which becomes purulent: a delicate cellular substance is developed upon the surface of the wound which, by the shooting forwards of the capillary vessels into it, forms granulations; these at first are very delicate, and bleed on the slightest touch, but by degrees become firmer, draw together towards their middle, and thus diminish the extent of the wound; the granulations are covered with a delicate cuticle, and a whitish, skinny, imperspirable covering called a *Scar* (*Cicatrix*, Lat.; *Narbe*, Germ.; *Cicatrice*, Fr.) is produced. This is the cure of wounds by means of *suppuration* and *cicatrization* (*Reunio per secundam intentionem*, Lat.; *Heilung der Wunden auf dem Wege der Eiterung und Vernarbung*, Germ.)

In all the higher animal organisms the special reproduction of lost parts is dependent only on the production of cellular tissue, by means of which the bones may be partially reproduced by the deposit of phosphate of lime. The solution of continuity of other parts is, however, only replaced by a-cellular deposit; which, indeed, may assume a tough fibrous structure. but never can acquire the organization of the lost or divided part. The opinions, in regard to the reproduction of nervous substance, however, are still very various, as will be seen hereafter.

["When the adhesive inflammation" says **John Hunter**, "is not capable of resolution, and has gone back as far as possible to prevent the necessity of suppuration, especially in those cases that might have admitted of a resolution, as in spontaneous inflammations in general, where there has neither been an exposed laceration of the solids, nor, as before mentioned, loss of substance, but where the natural functions of the part have only been so deranged that it was unable to fall back into a natural and sound state again; or, secondly, where it was a consequence of such accidents as the effects of the adhesion could not in the least prevent, (as in wounds that were prevented from healing by the first or second intention,) then, under either of these two circumstances, suppuration takes place. The immediate effect of suppuration is the produce of pus, from the inflamed surface, which appears in such cases, or under such circumstances, to be a leading step to the formation of a new substance called granulations, which are the third method, in the first order of parts, of restoring those parts to health." (p. 371.)

"Granulations are an accretion of animal matter upon the wounded or exposed surface; they are formed by an exudation of the coagulating lymph from the vessels, into which new substance both the old vessels very probably extend, and also entirely new ones form, so that the granulations come to be very vascular, and indeed they are more so than almost any other animal substance." (p. 477.)

"Immediately upon the formation of the granulations cicatrization would appear to be in view. The parts which had receded, in consequence of a breach being made into them, by their natural elasticity, and probably by muscular contraction, now begin to be brought together by this new substance; and it being endowed with such properties, they soon begin to contract, which is a sign that cicatrization is soon to follow. The contraction takes place in every point, but principally from edge to edge, which brings the circumference of the sore towards the centre; so that the sore becomes smaller and smaller, although there is little or no new skin formed. The contracting tendency is in some degree proportioned to the general healing disposition of the sore, and the looseness of the parts on which they are formed; for, when it has not a tendency to skin, the granulations do not so readily contract, and, therefore, contracting and skining are probably effects of one cause." (p. 483.) A principal use of the contraction of granulations is, that "it avoids the formation of much new skin, an effect very evident in all sores which are healed, especially in sound parts. * * * After the whole is skinned, we find that the substance, which is the remains of the granulations on which the new skin is formed, still continues to contract, till hardly anything more is left than what the new skin stands upon. This is a very small part in comparison with the first formed granulations, and it in time loses most of its apparent vessels, becomes white and ligamentous. For we may observe, that all newly healed sores are redder than common skin, but in time they become much whiter." (p. 485.)

The following is the very interesting and important history of the process of filling up a gaping wound, as described by TRAVERS:—"In a wound with loss of substance, which offers the most complete example of organization, the fibrine is very gradually deposited, little by little, at its margin, preserving at all points an uniform line of approximation to the centre. The margin is elevated, rounded, and opake at its base; its salient edge is thin, sharp, and transparent. This presents no appearance of vascularity during the process, but the circumjacent vessels are observed to multiply and extend their branches of communication or anastomosis. These processes go *pari passu* towards the healing of the breach; the fibrine becoming fuller and more opake where it adjoins the original texture, and in the same proportion encroaching upon the void space. The wound preserving its figure, continues to diminish as the surrounding parts become organised by the production of transparent capillaries from the nearest vessels, in forks and arches of communication one with another, parallel for the most part to the margin of the wound. These vessels are visible in fine striæ before circulation can be detected. A single globule is first observed to enter, and this is followed by more, which have only an oscillatory motion for many hours, a flux and reflux derived from the impulse of the circulation in the parent capillaries, which see-saw movement continues gradually gaining in the direction of the nearest neighbouring vessel, into which at length the pioneer globules enter in single file. The next stage is the abrupt and rapid occasional transit of a globule, or of several isolated globules in succession, through the new channels, just as drops of rain course one another down a window-pane in the same track.

"The conclusion of the process is a regular uninterrupted transition of a file of globules, by which a cross branch of communication is established. This is the simplest example, but the complications of anastomosis proceed in a similar manner. Instead of the meeting of parent vessels, one new vessel encounters another, and they join and divaricate at an angle; or one, meeting another current in an opposite direction, is reflected at an angle so acute as to be refluent upon itself to the vessel from which it emanated, or to contiguous *ramusculi* from the same parent; and thus arches and circles forming a mesh of anastomosis are established.

"The nascent blood-vessels appear in the first instance destitute of colour, by reason of the paucity of the blood-globules which they convey. When perfected, enlarged, and multiplied, they become the nourishing vessels, arteries, and veins of the new texture, the motion of the blood being, as they are arteries or veins, conformable to that of the original texture. The appearances of vessels striking directly across the newly deposited lymph to meet their opposites—of vessels seemingly engrooved in the lymph by a train of blood globules pioneering their track—of insular specks and zones in the fibrinous deposit, which generate and throw off pencils of vessels for anastomosis with each other and with those proceeding from the margin—are doubtless presented at different stages of the process; but, being the result of occasional and partial observations, have been inaccurately dated and explained. The whole business of organization is of and from the margin of the wound; and it is upon the margin, and its gradually developed organization and encroachment, that the healing action is first and last seen, *i. e.*, until its obliteration by the cicatrix. There is no such thing as isolated or independent vascularization, although appearances exist that convey this impression, as will be afterwards shown. The centripetal or convergent arrangement is the presiding and consummating genius of the operation; but the inherent contractility of the fibrine, and the primary institution of a fuller and freer anastomosis of the nearest marginal vessels, modify the process of organization, and render the centre, as it is the most distant point, the last vestige of its completion. The loop, fork, or arch, consists of an *arteria* and *vena* "*comites*," so that the continuity of circulation keeps pace with the extension of vascularization. It is the opening out of the angle of reflection which presents these varieties of arrangement at different periods, and explains the purpose of its existence and uniformity." (p. 76–9.)

BENNETT thus describes the process of granulation and cicatrization:—

"When, however, the lips of the wound remain apart, or there has been loss of substance, the exudation is more copious externally than internally. The portion which is infiltrated into the tissue surrounding the sore, constituting the inflamed, red, and indurated margin, is transformed into exudation cells, which, on breaking up, are absorbed. Some of these occasionally find their way to the surface, and become mixed with pus-corpuscles, a circumstance which probably, with some, has supported the supposition that these structures are different stages of one growth. On the other hand, the exudation which is poured out externally on the surface of the sore is very abundant, and is transformed partly into the pus-cells, and partly into primary cells, which are, by the process of development, converted into fibres, and ultimately constitute the cicatrix. The portions of exudation which are undergoing this process are called granulations. As these become more numerous, the amount of pus diminishes, and a greater tendency is manifested in the exudation to pass into permanent tissue. At length pus ceases to be produced; the whole exudation passes into fibres; a new surface is formed, the which contracting, after a time constitutes a cicatrix. In this case a greater amount of fluid exudation is poured out on the surface of the sore than into the neighbouring tissues, because externally the capillaries are more attenuated, and nothing obstructs the exudation. As new tissue is formed, new vessels are also produced, which, in their turn, assist in pouring out blood plasma on the surface. Internally the vessels are more uniformly supported by dense tissue, and the amount exuded in that direction is not so great. A section of a granulating sore at this time presents the following appearances:—Among the tissues constituting the edge of the ulcer there is considerable granular exudation, with exudation cells and masses. The base is entirely made up uniformly of filamentous tissue; above, of cells varying in shape and passing into fibres, and most superficially of purulent matter." (pp. 61, 2.)

Of "*Healing by the second intention or granulation*," WHARTON JONES observes:—

"This is a slower process than adhesion. The inflammatory congestion persisting, matter continues to be exuded. One part of it is converted into cellular tissue and capillaries—granulations are composed of these new tissues in process of development; another part is converted into pus, which, as above said, serves as a sort of epithelium to the granulations. As the healing approaches completion, the quantity of exuded matter converted into pus becomes less and less, in comparison with that expended in the formation of tissues. At last, no more pus being formed, the exuded matter is developed into epithelium or epidermis, and cicatrization is in this case also completed. As this takes place, the granulations contract and become less vascular, by the shrinking and disappearance of many of the vessels which existed in them, as is so distinctly observable in the case of the cornea, in regard to all the vessels." (p. 280.)]

273. The following points are to be noticed in the prognosis of wounds:—

1. *The condition of the wound.* The cleaner the division of the part, the more easily and quickly does it heal; the more the parts are bruised, the more severe is the injury, and the more tedious the cure. Thrust wounds are generally not more dangerous than cut wounds; they are, however, more frequently connected with bruising and partial division of the separate structures; the bleeding is more difficult to stanch, and, if quick union do not take place, the fistulous form of the wound easily produces burrowing and stagnation of pus. If foreign bodies be in the wound, the prognosis depends on the possibility of their removal, or, if there be deleterious substances in it, upon preventing their operation upon the whole organism.

2. *The age and constitution of the wounded person.* In young healthy subjects, wounds heal better than in old cachetic persons affected with syphilis, scrofula, scurvy, and the like, in whom wounds rarely heal by quick union, but, on the contrary, are converted into sores, which assume the character of the general disease.

3. *The importance of the injured parts.* A wound is more dangerous, as the parts affected by it are more important, and the more severe the injury is in itself. In this respect, wounds are divided into ***absolutely mortal***

(*Vulnera absolutè lethalia*, Lat.; *Wunden absolut tödtliche*, Germ.; *Plaies absolument mortelles*, Fr.) and *accidentally mortal* (*Vulnera per accidens lethalia*, Lat.; *Wundenzufällig tödtliche*, Germ.; *Plaies consécutivement mortelles*, Fr.) In the former, cure is impossible, although the precise period of death may be difficult to determine; in the latter, the mortality depends on accidental circumstances, which are grounded *on the individual condition of the patient, in the improper use, or in the absence of artificial aid, and in the complication of the diseases.* This division of wounds has reference simply to the position of the surgeon, not to that of the medical jurist. To this, also, may be referred the question, whether any, or what, permanent injury (*damnum permanens*) will remain after the cure?

4. *The structure of the wounded part.* Bleeding is free in vascular parts. If the vascular trunks of a limb be injured, the circulation depends, after the arrest of the bleeding, upon the expansion and increased activity of vessels of the second and third order. If this do not take place, the part dies. If the artery be only slit, there remains, in most cases, an aneurismal enlargement. If the principal nervous trunks of a part be torn, the part becomes paralytic and wasted; at least, it cannot be decided whether and when the nerves will again become active. Injuries of nerves in general, and especially if the nerve be not perfectly divided, usually produce severe symptoms, spasms, convulsions, and the like. Wounds of bones are not in reality different from those of soft parts, except that, when the periosteum has become much affected, and suppuration has taken place, the latter is tedious, and the structure of the bone may become much altered. Wounds of glandular and secreting organs heal with difficulty, suppuration commonly takes place, and the pus is changed by mingling with the secreted fluids. Wounds of joints, especially of the larger ones, are always very dangerous.

5. Wounds which *penetrate the cavities of our body* are dangerous from inflammation, from collection in them of blood, pus, and so on; and from the injury of some of the *viscera* which they contain.

6. Besides these, the *mode of life of the wounded person*, the following up of a proper plan of treatment, and the appearances accompanying a wound, are decisive as to its danger.

274. In the *treatment* of Wounds, it is especially necessary, the bleeding having been stanched, that all foreign bodies should be carefully removed. The cure is to be attempted according to the different character of the wound, by quick union, or by suppuration and cicatrization, and the symptoms which may come on must be counteracted.

275. The most perfect knowledge of the form, depth, and direction of the wound, of the condition of the wounded parts, and of the presence or absence of foreign bodies, must be obtained by examination. A mere glance at a wound is commonly sufficient to distinguish the points just mentioned. The most favourable time for examining the wound is immediately after its infliction, before inflammation has come on, as otherwise the examination is more difficult and painful. It is generally easy in cut wounds, but more difficult in stabs and gun-shot wounds. In making the examination, the surgeon must be guided by his anatomical knowledge of the parts, the attitude in which the person was when wounded, the direction and violence with which the instrument penetrated, as well as the nature of the matter escaping from the wound, and the symptoms which ensued at the time. If,

when the wound has been properly cleansed, the surgeon cannot obtain satisfactory information, he must use his finger or the probe. Whenever it is possible, the finger is always to be preferred, because the feeling with it is more perfect, and the examination less painful. Probes for examining wounds must be made of silver, furnished with a button at the end, suitably thick and flexible. When the patient has been put into the position in which he received the injury, the probe, loosely held between the fingers, is to be introduced into the wound. If it cannot be found out what his position was, the wound must be probed in different directions. Without a definite reason and object, the wound is never to be probed, because thereby increased irritation, and return of bleeding, and so on, are but too easily set up.

276. The *bleeding* in every wound requires the greatest attention, and, if it be severe the most prompt treatment. The vessels from which the bleeding occurs, are either partially wounded or perfectly divided. The blood from an artery, if not poured into the cellular tissue, spirts out, bright red, frothy, and in interrupted curves; from a wounded vein, dark blood flows in an unbroken stream. Arterial bleeding is stopped by pressure of the vessel between the heart and the wound, but venous by pressure on the opposite side of the wound. The bleeding either ceases of itself, or is stopped by various artificial assistance.

277. Nature often stops the bleeding, even from large vessels, by the following means :—If the artery be perfectly divided, it retracts into the cellular tissue by which it is surrounded; at the same time, the divided extremity contracts circularly. This contraction is not sufficient to arrest the pressing stream of blood, which flows from the end of the artery into the canal of the cellular sheath, and thence outwards. By the retraction of the artery, the cellular tissue connecting it with its sheath becomes stretched and uneven at the inner surface of this sheath. In these irregularities the blood lodges and coagulates, by which the area of the sheath is diminished, and at last completely plugged up. The contact of air, and the diminished power of the circulation, depending on the loss of blood, seem to assist the coagulation. From the divided end of the artery to the next collateral branch, the blood stagnates in the canal of the vessel and forms a clot, not, however, perfectly filling its area, and only slightly connected with it at its divided end. From this cut of the artery, coagulable lymph is poured out, which deposits itself between the *inner* and *outer* clot, and closes the mouth of the vessel completely; at the same time, the end of the artery is connected to the surrounding parts by the exuding lymph, and is thereby secured against the pressure of the blood. The artery, from its point of division to the nearest collateral branch, is gradually converted into a ligamentous structure, of which the canal is completely obliterated: the coagulated blood is absorbed; the lymph poured out in the neighbouring cellular tissue gradually disappears, and the parts resume their cellular condition. The same changes also occur in that end of the artery farthest from the heart (*a*).

The changes which the blood-clot (*thrombus*) undergoes in the canal of the artery are the following: between the fifteenth and thirtieth hours, it becomes bright red in

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(*a*) Jones, J. F. D., M.D., A Treatise on the Process employed by Nature in suppressing the Hæmorrhage from divided and punctured Arteries, and on the use of the Ligature; with Observations on Secondary Hæmorrhage. London, 1805. 8vo.

Ebel, Thos., De Naturâ Medicatrice sicubi Arteriæ vulneratæ et ligatæ fuerint. Giessæ, 1826. 4to.

Amussat; in Mémoires de l'Académie Royale de Médecine, vol v. fasc. 1.

Sanson, Des Hémorrhagies traumatiques, avec une pl. col. Paris, 1836.

the middle, and especially towards its end, and also in some larger or smaller roundish and irregular spots, of a lighter colour on the surface. Vessels shoot into it, which are distinguishable with a lens, and can be injected (STILLING, BLANDIN.) Hence the clot assumes the appearance of granulations, and has a fleshy colour. The union of the clot with the inner wall of the vessel proceeds correspondingly. The extremity of the vessel at last loses its texture, shrivels up in the clot, the plastic lymph, which had been poured out between the coats of the vessel, is absorbed, and the end of the vessel, with the contracted clot, forms a fibro-ligamentous mass which change takes place, in small vessels, in from twenty to twenty-two, and in large vessels in from forty to fifty days. Gradually, however, the extremity of the vessel, as well as the clot, become absorbed up to the next collateral branch, and new tortuous vessels sprout from the vascular stump, as JONES, EBEL, and others, have observed. Compare STILLING (*a*).

Such is the true description, obtained from careful observation, of the processes by which the stanching of blood is effected by nature. All the earlier writers on this subject have directed their attention only to one or other of these processes. Thus, PETIT (*b*) thought that a plug of coagulated blood was formed partly within and partly without the walls of the artery, which united with the inner surface of the artery, with its wounded edge, and with the surrounding parts. MORAND (*c*) allowed, indeed, the blood-clot had some participation in stanching the blood; but he thought that the circular contraction of the artery, by which its area is diminished, its retraction, and the consequent thickening, of its longitudinal fibres, were the most important means. Of the same opinion, also, were SHARP, GOOCH, KIRKLAND, and others. POUTEAU (*d*) denied the importance of the blood-clot and the retraction of the artery; and asserted that the swelling of the cellular tissue, and the parts surrounding the wounded artery, opposed the greatest resistance to the out-pouring blood. JOHN BELL (*e*) expresses the same opinion. See also TEXTOR (*f*).

HUMMEL (*g*) supposes that, besides the processes mentioned, (which he himself does not admit,) other circumstances participate in stanching the blood, which are founded in the autocrasy of nature, and, in this instance, on the laws of derivation. He points out three periods: 1. The coats of the vessels separate from each other, and, therefore, proportionally, the blood flows more quickly; 2. The flow of blood is diminished, derivation begins, the blood-corpuscles cease to flow where they are not wanted, and where they only become annihilated; 3. The blood coagulates, the derivation is perfected, the bleeding ceases. The shriveling up of the vessels he holds to be fictitious! If such teleological views have any real meaning, we must seek the causes of the turning back of the stream of blood, if the bleeding be of some duration, in the increased vicarious activity of the uninjured branches; and when the entire part is removed, we must seek the cause in the want of power to draw blood into the distant limb, and in the consequent diminished flow of blood.

278. Bleeding, in partial division of arteries, especially in transverse wounds, is rarely stanched by nature. Their complete rupture is rarely accompanied with great loss of blood; their inner surface is torn, drawn together at several points, and they contain coagulated blood. In punctured wounds of arteries the blood rarely flows freely through the external opening of the wound, but pours out between the artery and its sheath, where it coagulates and blocks up the opening of the artery. This closure continues for a shorter or a longer time, but, if the arterial wound be not closed by the process of adhesive inflammation, or, if the canal of the artery be not obliterated, yields to the pressure of the blood which pours from the wounded artery into its sheath, and dilates the latter into a circumscribed swelling, which gradually increases and pulsates, but the pulsation of which ceases, if the artery be compressed between it and the heart; and, if the pressure be continued sufficiently long, the swelling is immediately diminished, or it entirely disappears (*Aneurysma spurium*,

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(*a*) Die Bildung und Metamorphose des Blutpropfes oder Thrombus in verletzen Blutgefässen. Eisenach, 1834.

(*b*) Mémoires de l'Académie Royale des Sciences, A.D. 1731-1735.

(*c*) Ib., A.D. 1736, p. 58.

(*d*) Mélanges de Chirurgie, Lyon, 1710, p. 299.

(*e*) Principles of Surgery, vol. i. p. 179.

(*f*) Grundzüge zur Lehre der chirurg. Operationen. Würzb., 1835, p. 37.

(*g*) Inaug. Abh. über traumatische Gefässblutungen. Würzburg, 1838.

circumscriptum seu *consecutivum*.) If the blood cannot escape by the external opening of the wound, it extravasates into the cellular tissue of the whole limb, which swells up considerably (*Aneurysma spurium diffusum* seu *primitivum*.)

279. In slight and, especially, in longitudinal wounds of arteries, observation proves the *possibility* of the wounded edges uniting, by the process of adhesive inflammation, and the area of the artery being preserved, so that after a time no trace of a scar, either on the outer or inner surface of the artery, can be discovered. But, in every considerable wound of an artery, its canal is diminished by the outpouring of the coagulable lymph (*a*).

The experiments, however, of Saviard (*b*), Petit (*c*), and Scarpa (*d*), show that, if the healing of an arterial wound take place with preservation of its tube, the wound of the artery is *not ever* cicatrized, but may be closed by a plug of plastic matter, which is firmly connected with the vessel.

280. The means by which bleeding may be stanched are, the *compression*, *ligature*, and *torsion* of arteries, *styptic astringent remedies* and *cauterization*.

281. The *compression* of arteries is either mediate or immediate. The artery is mediately compressed by pressing it, between the wounded part and the heart, with the finger, with the tourniquet, with special compresses, with graduated compresses, and with tightly drawn bandages. By mediate compression, the last two methods excepted, we guard, rather, against bleeding, (for instance, in surgical operations,) or merely employ it for the moment, till more suitable assistance is obtained, as the strangulation of the limb, unavoidably attending this compression, cannot generally be long borne.

282. Pressure with the fingers is to be performed with one or both thumbs upon some part of the artery where it is superficial, and lies near a bone, for instance, on the horizontal branch of the pubic bone, in the course of the brachial artery, the subclavian artery above the clavicle on the first rib, &c. A proper compressor may also be used instead of the finger, which may be made to press on the given place; as the compressor of Ehrlich (*e*), the place of which, on an emergency, may be supplied with a key, or a boot-hook covered with linen.

283. The *tourniquet* (*torcular*, *tornaculum*) is divided into two kinds, that which, besides compressing the artery, also presses around the whole limb, and that which compresses only the principal trunk of the artery. To the former kind belongs the *field* or *stick tourniquet*, (invented by Morell at the siege of Besançon, in 1674,) of which there are various modifications, as the *screw tourniquet*, the simple contrivances of the *English field tourniquet*, and of Assalini's *buckle tourniquet*. Morell's tourniquet consists of a pad stuffed with hair, of a strong bandage, an ell and a half, or two ells long, of a stick of tough wood, and of a piece of leather which has on both sides a cut for the passage of the bandage. The screw tourniquet is similar to the former, in that the bandage which passes over the pad is tightened by means of a screw which rests on the side of the limb opposite to the pad. The tourniquet which merely compresses the principal trunk of the artery, without circularly pressing on the whole limb, is that of Petit, who, as his

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(*a*) Jones, above cited: von Winter; in Siebold's Chiron, vol. i. p. 366; von Walther, ib., vol. iii. p. 83: Textor; in N. Chiron, vol. i. part iii. p. 423: von Winter, Beschreibung der Schlagader-Verletzung in rechten Ellenbogen Ihrer Majestät der Königin von Baiern, u. s. w. (printed from the Neue Chiron., vol. iii.) Sulzbach, 1825; in the same paper are also found collected many old observations connected with this subject.

(*b*) Journal des Sçavans, A.D. 1691.

(*c*) Mém. de l Acad. de Chirurg., vol. vi. p. 251.

(*d*) Sull' Aneurisma Reflessioni ed Osservazioni Anatomico-Chirurgiche. Pavia, 1804. fol.

(*e*) Chirurgische Beobachtungen, vol. i. plate ii. fig. 5.

tourniquet is also a screw tourniquet, is usually considered as the inventor of the latter. The screw tourniquet is most convenient when the upper brass-plate is connected by two or four steel rods with the under one, by which the upper plate is steadied whilst the screw is twisted.

Upon the history of the tourniquet and its various modifications—

Kellie, Observations on the Medical Effects of Compression by the Tourniquet. Edinburgh, 1797. 8vo.

Westphalen, Dissert. sistens Tornaculorum criticem atque novam ex emendatione recentiori speciem. Jenæ, 1800.

Krombolz, Abhandlungen aus Gebiete der gesammten Akologie. Mit 9 lithogr. Tafeln. Prag. 1825. 4to. p. 1--120.

Klein and Dupuytren's Compressor.

284. In the application of the tourniquet, the position of the artery must be first ascertained, on the upper arm, at the inner edge of the *m. biceps;* on the thigh, in the triangular space between the *m. addactor* and *vastus internus;* also above the knee in the hollow formed by the tendons of the *m. biceps* on the outer, and of the *semitendinosus* and *semimembranosus* on the inside; the pad is then, at either of these parts, to be closely placed upon the track of the artery, and the bandage having been carried over it, and around the limb, its two ends (which, in Morell's tourniquet, are to be passed through the slits in the leather plate) are tied upon it, then twisted with the twisting-stick, and the latter fastened by means of small strings. In the screw-tourniquet, however, the bandage is drawn together by means of the buckle; and the tourniquet itself, of which the two plates must be screwed down, so as to touch each other, must be put upon the side of the limb opposite to the pad, where a compress, or piece of leather or pasteboard, should be put to relieve the severe pressure. In twisting the screw, the lower plate must be fixed with the hand, and the slipping of the pad prevented. The degree of compression is to be measured by the cessation of pulsation below the tourniquet, or by the cessation of the bleeding, which may be taking place. A sufficiently stout pad is preferable to a roller or a graduated compress.

[In applying the screw tourniquet, I think it better to adjust the pad beneath the lower plate of the screw, as the pressure is more steady and direct when the one is below the other. It is better also that one end of the tourniquet bandage should have a buckle to fasten by buckling rather than by tying, as there is less chance of the apparatus slipping.—J. F. S.]

285. In cases where a tourniquet cannot be applied, and where pressure may be long continued, without compression of the whole limb, special compressors are proposed, that of Langenbeck (*a*) and Verdier (*b*) for the external iliac artery; of Mohrenheim (*c*) and Dahl (*d*) for the subclavian; of Wegehausen (*e*) and Moore (*f*) for the upper and lower limbs; and of Graëfe (*g*) for bleeding from the palm of the hand.

To this subject also belong the different kinds of compressors which have been proposed for wounded brachial artery, at the bend of the elbow, by Scultetus, Heister, Dionis, Plattner, Brambilla, Desault, Leber, Ayres, and so on; for the temporal artery, by Bell; in bleeding from the veins of the neck, by Chabert; from the tongue, by

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(*a*) Bibliothek für die Chirurgie, vol. i. part ii. plate ii.

(*b*) Mémoire sur un Appareil Compressif de l'Artère Iliaque externe, etc. Paris, 1823.

(*c*) Beobachtungen verschiedenen chirurg. Vorfälle, Wien, 1780, vol. i. pl. i. fig. 6, 7.

(*d*) Platner's Zusatze zu seines Vater's Chirurgie, pl. iii. fig. 3.

(*e*) Rust's Magazin, vol. ii. part iii. pl. iv. v. vi.

(*f*) Bernstein Systematische Darstellung des chirurg. Verbandes, pl. x. fig. 104, 105, 106.

(*g*) In Journal für Chirurgie und Augenheilkunde, vol. xvii. p. 305.

Lampe; from the meningeal artery, by **Faulquier** and **Graëfe**; for the epigastric artery, by **Schendler** and **Hesselback**; and from bleeding from the penis, by **Joachim**.

[For the purpose of suppressing the bleeding from arteries **Carlisle** (*a*) proposed the following plan of applying the tourniquet on the lower extremities:—" A hard roll of linen bandage, about four or five inches in width and three in thickness, being provided, and a piece of smooth board, nine inches in length, five in width, and three-quarters of an inch in thickness, with the sides and ends squared at right angles, the roller is to be placed on the ham midway between the external and internal flexor tendons on the under sides of the knee-joint, the leg being extended in a straight line; the piece of board is then to be placed over the roller, which is to act as a pad of compression on the popliteal artery, the length of the board running crosswise, and projecting beyond the knee-joint on each side. The girth of the tourniquet is to go round the knee above (not upon) the patella, and over the projecting ends of the board. The screw should rest at the upper part of the limb above the patella, having a pad interposed between it and the skin. This mode of compressing the popliteal artery is attended with an important advantage; it allows the arterial circulation by the lateral anastomosing vessels to proceed uninterrupted; the large superficial veins also are undisturbed, so that the limb remains in the same state as if the artery alone had been tied." He does not think it applicable at amputation, but "in all cases of hæmorrhage, when there is a chance of saving the limb, it will be found preferable to the total stoppage of circulation by the ordinary methods." (pp. 23, 4.)

A much better apparatus for keeping up pressure than that of **Carlisle**'s is the ring tourniquet, which was first introduced at St. Thomas's Hospital by **Tyrrell** (*b*), though I am doubtful whether he was the inventor. It has often been employed since, and is a very good instrument for the purpose.

"The ring tourniquet consists of a metal ring, having a diameter larger than that of the limb to which it is to be applied, and a width of about an inch; the circumference is tapped at one point so as to admit a screw, to the inner extremity of which a pad is fixed, and to the outer end a small handle to turn the screw with, by the action of which the pad can be carried to or from the centre of the circle. When applied, this instrument makes pressure only on two parts; by the pad on the site of the artery, and by the portion of the ring immediately opposed to the pad, on the surface of the limb directly opposed to the position of the artery: thus it does not interfere with the lateral circulation." (p. 20.)

On much the same principle is the arch tourniquet of Dr. **Oke** (*c*), of Southampton, which "consists of an arch, a pad, and screw. The flanks of the arch are perforated with holes for the action of the external screw, which is worked by a short handle, as in the common tourniquet. The pad is of the ordinary size, flat on one side and convex on the other. Upon its flat surface there is a smooth cavity for the reception and working of the point of the screw. *Mode of application*:—Let the arch embrace the limb, so that one of the perforations of the flank may be exactly opposite the cavity on the flat side of the pad, previously applied over the trunk of the artery to be compressed;' then fit the external into the internal screw, and work it upon the pad till sufficient pressure be made to stop the circulation of the artery." (p. 151.)]

286. The *compressing apparatus*, which is applied directly upon the wounded part, consists either in the application of special compresses, as mentioned in the former paragraph, or in the *application of a bandage enclosing the whole limb*. The application of the compressor has great disadvantages, as, on account of the pain and inflammation, it commonly cannot be worn sufficiently long; the flow of blood through the whole limb is checked, or a complete flattening of the artery, if it be not very superficial, and lie immediately on a bone, cannot be effected. For this reason, therefore, if the compressing apparatus is to be used, especially in wounds of the elbow, bandaging the limb is preferable to the use of compressors. After the bleeding has been arrested, by pressure on the artery between the wounded part and the heart, the wound is to be cleansed,

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(*a*) A New Method of applying the Tourniquet, &c.; in Medical and Physical Journal, vol. i. London, 1799.

(*b*) St. Thomas's Hospital Reports.

(*c*) Provincial Medical Journal, 1843.

any extravasated blood is to be removed by gentle pressure, the edges of the wound are to be brought into pretty close apposition, and connected with sticking plaster, which is to be wound round the limb, or a small compress is to be placed on the wound, and a sufficiently long bandage turned eight times round the joint, a graduated compress is to be put along the track of the artery, and the whole finished by wrapping up the entire limb. The bandage is to be left alone till it loosens, when it must be reapplied in the same way. The wound may close very easily in six days, when a hard swelling is commonly to be perceived, which is caused by the loosening up of the cellular tissue, and more or less extravasation of blood; this is dispersed by the continued use of a tightly applied bandage. The observations of VON WINTER (1) have especially shown, that, under this treatment, which is applicable only to small longitudinal (punctured) wounds of arteries, the healing may take place, and, perhaps, usually does take place with preservation of the canal of the artery.

(1) VON WINTER recommended that this apparatus should consist of bandages made up of linen four times folded, two inches wide, and of the length of a sheet, and that over this the circular bandage should be rolled, inasmuch as such an apparatus sits closer, and does not so easily get loose as the common bandage, applied according to THEDEN's plan.

287. *Immediate or direct compression* consists in laying some charpie, rolled together, or pieces of agaric, sprinkled or moistened with styptic remedies, upon the mouth of the bleeding vessel, and fixing it tightly by a suitable bandage. This kind of blood-stanching is less certain, and, as regards the healing of the wound, very injurious (1). It must, therefore, be employed only in those cases where tying the bleeding artery is not possible; for instance, if the blood wells up from the whole surface of a wound, in wounds of the meningeal artery (2), in severe bleeding from the nose (3), after the operation of cutting for the stone (4), and so on. This compression most certainly stops the bleeding when the artery can be compressed against a bone (5).

[(1) When direct pressure is employed, as a general rule, it is best not to use any styptic, but trust entirely to the finger, keeping up the pressure, it may be for hours, by a relief of assistants. But very commonly obstinate oozing, where no particular vessel can be observed, or where a score of minute vessels seem to need the application of ligatures, and the surgeon's patience is tired by finding that for every one he ties, two more bleed, may be completely checked, after once or twice gently sponging the wound with cold or tepid water, and carefully removing the smallest portion of clot, and leaving it exposed to the air for three or four hours, during which the whole surface of the wound is glazed with a thin layer of fibrinous exudation and the mouths of the little vessels sealed up. The bleeding in such cases seems to depend on the imperfect closing of the smaller or capillary arteries, which, having in themselves little contractile power, continue to permit the escape of the blood, if the clot first formed in them be disturbed, as is doubtless often the case in cleaning the wound previous to bringing it together; and, indeed, the disturbed clot actually irritates the vessel to bleed till it has been washed off.

The objection to styptics, of whatever kind, is that sloughing to a greater extent occurs after their use, than after the mere application of pressure.

In external wounds which continue bleeding, after exposure to the air, if the vessel cannot be found, a piece of cork, or any other hard substance, covered with lint, and bound on tightly with a bandage, is often very useful.

(2) Pressure on the meningeal artery is on no account to be employed, for it would be inconvenient to the brain. Nor indeed is it ever necessary; the removal of all the clot is quite sufficient to stop the bleeding, of which ABERNETHY gives an excellent instance in the case of a man who, having received a blow on the side of the head, had symptoms of compression, for which he was trephined, and, on elevating the bone, the meningeal artery, which had been wounded and formed a clot as big as a walnut, bled furiously, but ceased almost immediately on clearing away the blood.

(3) In bleeding from the nostrils, which is often very troublesome, the best remedy as a compress is a piece of dry sponge, which may be easily introduced in the following manner: A long stout thread having been attached to the extremity of a bougie, the armed end of the bougie is to be passed into the bleeding nostril, and carried back into the *pharynx*. The surgeon then passes his finger, or a pair of forceps, through the mouth into the throat, and, having found the thread, draws it forwards through the arch of the fauces and out of the mouth, leaving the bougie still remaining in the nose. To the thread thus drawn out a piece of dry sponge slightly greased is to be tied, and then the bougie gently drawn from the nostril, by doing which the thread pulls the sponge back into the throat, and against the hind opening of the nostril. The thread is still to be pulled, and the entrance of the sponge assisted by passing the finger into the *pharynx* and disengaging the sponge from the soft palate and thrusting it upwards; as soon as it is on a level with the floor of the nose all difficulty ceases, and, by pulling the thread, it can be fixed in any part of the nostril which may be chosen, but about midway is best. For performing this operation there is a clever French instrument (whose invention I do not know) which I brought many years since from Paris; it consists of a short catheter, the stilette of which, double the length of the tube, is a curved flat spring, having at its top, rounded as if it were the end of the catheter, and with an eye in it. The instrument is introduced with its point downwards, along the floor of the nose into the throat, and the stilette being thrust in, the curved spring projects into the mouth, and, being brought between the lips, a piece of thread and sponge is attached to it, after which the stilette is retracted, and with it the sponge, into the throat; the sponge is then pulled up close to the end of the stilette, and is easily introduced into the nostril; after which the instrument is to be withdrawn. With this apparatus the operation is performed in two or three minutes, with but little inconvenience to the patient, and it is far preferable to the bougie.

(4) Occasionally very severe bleeding occurs from wounding the pudic artery itself, or the division of one of its large branches close to the trunk during the lateral operation for the stone. Under such circumstances it is useless to attempt to hook up the vessel with a tenaculum, or to carry a ligature round it with a needle, for it is generally wounded so deeply that the exact situation of the wound cannot be seen. Under such circumstances pressure of the vessel with the finger, which is to be gently shifted till the bleeding is stopped, is the proper treatment to be pursued. I recollect a case of this kind during my studentship, in which either the internal pudic artery itself, or the artery of the bulb close to its origin, was wounded; the bleeding was very severe, and in the course of a few minutes the patient nearly died from the loss of blood. The finger was introduced into the wound, and the artery being found was readily pressed against the ascending branch of the haunch-bone, and the bleeding arrested; but it was necessary to keep up the pressure for fifteen hours.

(5) But it frequently happens in stabs into the thick fleshy parts of the hand or foot, that pressure is of no avail: it seems to answer the purpose for a time, perhaps for hours, after which the blood begins to find its way out beneath the compress, and free oozing occurs, and will continue to such extent as to blanch the patient's countenance and very seriously reduce his constitutional powers. In such cases some surgeons grope about in the wound, enlarging it or not as may suit their fancy, in search of a little vessel, which can scarcely be expected to be found, and which they rarely do find, but instead they render the disposition to bleeding greater, and also damage the tendinous and nervous structures, so that very serious consequences result. This practice is therefore very bad, and ought not to be pursued. It is quite right at first to sponge out the wound gently and carefully, and, finding the bleeding vessel, to tie it; but, if this cannot be effected, it should not be persisted in, and the edges of the wound having been brought lightly together, a constant application of lint dipped in cold water is to be made, and the hand or foot raised so considerably as to discourage the flow of blood towards the wound, and to encourage it from the wound; the patient being kept in the recumbent position in bed at the same time. This practice is often quite sufficient without anything further being required. Other surgeons, if the wound be in the hand, prefer taking up the radial or ulnar artery at the wrist, according as they believe the bleeding vessel to have its origin from one or other. But taking up one is rarely of much use on account of the communication between the vessels in the palm; and even if both be tied, their interosseal branches often carry sufficient into the hand to keep up the bleeding, so that at last it becomes necessary to tie the brachial artery also, which generally puts an end to the business. But it is a very serious and painful proceeding for the patient, and the practitioner before adopting it should be well assured of its necessity. When bleeding continues after the use of compression, it very frequently ceases by removing the pres-

sure, and after clearing out the clotted blood, placing the hand as first mentioned, raised much above the elbow, and constantly applying cold wet linen over the wound. This practice I have often adopted successfully, and at any rate it should always be employed before cutting upon the arterial trunk above.—J. F. S.]

288. The *Tying* or *Ligature* (*Ligatura*) of a bleeding artery is the most simple, certain, and, in most cases, practicable method of stanching the blood. The operation of the ligature consists in its preventing the current of the blood, and, by its irritation, producing inflammation, exudation of plastic lymph, and union of the coats of the artery. This takes place as well when the arterial coats are kept merely in contact by the ligature, as when the inner and middle coats are torn through by means of the tightening and the small size of the ligature, the outer coat alone remaining undivided.

Jones, supported by his experiments, asserts that the cutting through of the inner and middle coats is necessary to produce such degree of inflammation as is sufficient to effect the union of the apposed arterial coats; and further, that this cutting through of the inner and middle coats, in tying arteries in their course, is sufficient to produce the union of the vessel, even although the ligature be immediately removed. That this cutting through of the inner and middle coats of the artery is not necessary, however, to produce the union of the arterial coats, is proved by the experiments in which arteries were brought to close by continued pressure, or by the use of broad ligaments, without tearing the inner and middle coats. Crampton (*a*) and Scarpa (*b*) have proved, by their experiments, that the inner arterial coats, which belong to the class of serous membranes, are well disposed, without requiring division, to adhesive inflammation, and to the pouring out of plastic lymph; and a continued compression suffices to bring the artery to adhesion.

[In brutes not even continued compression is necessary to produce the adhesion and obliteration of an artery, for I remember many years since passing a ligature around the carotid of a dog and tying it so loosely, as not merely to offer no obstruction to the flow of blood, but also to admit the introduction of a probe between it and the artery, without causing any compression, yet in the course of three weeks, at the end of which the animal was destroyed, the artery had become obliterated for two or three inches. I should, however, be sorry to attempt such practice on the human subject.—J. F. S.]

289. Upon this difference in the operation of the ligature depends the variety of its application, as practised by surgeons. Those who hold the cutting through of the inner arterial coats necessary, use a round thread, not very thick, and sufficiently strong, wherewith the artery is so firmly drawn together, that only the latter coat remains undivided. Others who maintain the opposite opinion, endeavour to flatten the artery, and bring its walls into close contact by the broad ligature (in tying arteries in their course, even by means of a cylinder of wood or linen placed beneath it;) in which case they tie the ligature only so tight as is necessary to prevent the current of the blood. They object to the division of the inner coat on the ground that the division of the arterial coats, effected by means of a ligature, rather resembles a torn and bruised than a cut wound, and is consequently more prone to suppuration; that the ligature does not bring into contact the two divided coats of the artery, but only the puckered walls of the external coat, and that in suppuration, after-bleeding occurs much more readily, inasmuch as the outer coat of the artery is little capable of withstanding the pressure of the blood.

[Although English Surgeons differ as to the size of the ligature to be used for tying arteries, some preferring a thinner and others a thicker one, yet there are few, if any, who do not now tie the vessel sufficiently tight to produce division of the internal coat, for which purpose, however, it is not necessary to employ the vigorous efforts which are

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(*a*) An Account of a New Method of operating for the cure of external Aneurism; with some observations and experiments illustrative of the effects of the different methods of procuring the obliteration of the Arteries; in the Medico-Chirurg. Trans., vol. vii. p. 341.

(*b*) Memoria sulla Legatura delle principali Arterie degli Arti; con una Appendice all' Opera sull' Aneurisma. Pavia, 1817. 4to.

often seen to be made. All the tightening of the thread, really necessary, is such as is sufficient to embed it in the arterial coats, so that it shall not be thrown off by the impulse of the blood against it.

The employment of a broad ligature, viz., ribbon, tied upon a piece of cork, and removing it some days before ulceration had taken place, was proposed and practised many years ago by the elder **Cline** in St. Thomas's Hospital; the first case failed, but the second succeeded; the preparation of the latter is now in the museum of that institution, the patient having died of diseased lungs three months after the operation. But subsequently it was found to produce great irritation, the cork acting as an extraneous body, and therefore the operation was given up. **Scarpa**, however, used a cylinder of linen, upon which the ligature was tied, thinking it preferable to wood, as being more like a cushion than anything which could bruise.

In cases of amputation, when, as occasionally happens, the arteries are ossified, **Manec** (*a*), who objects to tying such vessels at any time with small round ligatures, as likely to break up the diseased coats, in consequence of which bleeding happens between the second and fourth day, recommends the introduction of a piece of bougie into the ossified artery, as practised by **Dupuytren** and **Roux**. (p. 25.) I have not had any experience in this practice, and I do not remember to have seen bleeding of the wounds of old people, whose arteries are generally more or less ossified, more frequently than in other persons of younger age. Indeed, it occasionally happens, that the whole tube of the artery is filled with earthy matter, and impervious, therefore not requiring to be tied.—J. F. S.]

290. Notwithstanding these objections to the use of the simple round ligature, which cuts through the inner arterial coat, experience is in favour of this kind of ligature, inasmuch as the inflammation excited by it renders the obliteration of the artery more sure, and after-bleeding is more certainly prevented, because the vessel is perfectly closed before ceration of the outer arterial coat has caused the ligature to fall off.

This subject will be more fully considered in the treatment of aneurism.

291. In tying arteries the Surgeon must endeavour, as much as possible, to include none of the neighbouring parts in the ligature, and still not completely to isolate the artery. He seizes the mouth of the wounded vessel with the forceps, by laying the points of the instrument on each side of it and gently drawing it forwards. An assistant carries a round, not very thick, but sufficiently strong, waxed silk ligature, about the vessel, ties a single knot, and, whilst he holds the ends of the ligature with both hands, he draws the knot somewhat together, presses with both his fingers upon the artery, draws it sufficiently tight, and then makes a second simple knot.

The common forceps is certainly the best instrument to hold the divided vessel, and makes the tenaculum, and all the knick-knackeries which have been added to the forceps, superfluous. In case the surgeon has to perform the ligature of a vessel unassisted, it is best that the forceps should be furnished with a slide. Besides the old broad arterial forceps, must also be here mentioned **Brownfield**'s tenaculum, with the alterations of **Zang** and **Charles Bell**; the hook-forceps of **Assalini**; the forceps of **Brünninghausen**, of **Rust**; the forceps, with moveable auxiliary limbs, of **Blœmer** and **Assalini**, for projection of the loop; the tenaculum-forceps of **Weinhold**; the double tenaculum of **Weir**; the loop-drawer of **Jacobson**, for the application and drawing together of the ligature. Compare,

Holtze, E. G. F., De Arteriarum Ligatura; cum tab. xi. Berol., 1827. 4to.

Colombat's Forceps, in Revue Médicale, December 1829, p. 407.

Graëfe, Beschreibung zweier neuen Instrumenten zur Unterbindung trefleegender Gefässe; in his Journal, vol. xii. p. 651.

[I do not quite agree with **Chelius** as to the incomplete isolation of the artery before applying the ligature; but I do fully participate in his preference of the forceps to any other instrument for drawing out arteries. I always use two pair of forceps for taking

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(*a*) Traité théorique et pratique de la Ligature des Artères. Paris, 1832. fol.

up a large vessel; drawing it out with one pair, in the way he recommends, and then with the other clearing it entirely of *all* its surrounding connexions. This was the younger CLINE's practice, and I think very good, as it certainly excludes the accompanying nerve, which often excites severe pain and irritation. I am not, however, sure that the complete separation from the neighbouring parts at all hastens the throwing off the ligature.

The tenaculum is the instrument more generally employed in this country for taking up arteries; but I think it objectionable, as it commonly lifts up a large mass of soft parts which ought not to be included in the ligature.

It may not be amiss to observe here, that tying a ligature requires rather more attention than is commonly paid to it. Generally it is necessary to pass one end of the thread only once through the other, but some surgeons prefer twice, and sometimes this is convenient if the operator be short of assistants. Each thread is to be held by the forefinger and thumb of the corresponding hand, as near the wound as possible, and as the ends are drawn tight the middle finger of each hand is to be carried below the former upon the thread as close to the knot as possible, so as to pull upon the vessel with the least disturbance of its position. This is infinitely preferable to pulling at the ends of the thread two or three inches from the tie, and thereby dragging the artery up from its bed, as too commonly practised. Neither in making the second tie to complete the knot should one end of the thread be kept constantly in the same hand, and the other turned round it and then passed through the loop, as by this practice the knot is unsafe and often slips. But the first tie having been made, the finger of an assistant should be pressed slightly on, so as to keep it steady, whilst the two ends are carried across and made to change hands, after which the end not passed through the first loop should be put through the second, and the tie made as before. In this way both ends equally participate in the knot, and render it secure and safe. I have been particular in describing this seemingly trivial operation, because in reality it is a very serious one, as upon the fixity of the knot depends the patient's safety.—J. F. S.]

292. If the mouth of an artery have so retracted that it cannot be taken hold of, it is better to lay it bare by a careful incision, and to tie it alone, than to dip for it, (*als sie zu umstechen,*) that is, to carry, with a semicircular movement, a common-handled needle armed with a ligature through the neighbouring parts, on both sides of the vessel, and then to draw the threads sufficiently tight. The dipping is only necessary when the vessel has such firm adhesions that it cannot be taken hold of. If a pretty large injured artery cannot be laid bare within the wound, it is better to expose it between the wounded part and the heart, and tie it there.

On large arteries, (the branches of which anastomose freely,) whether partially or completely divided, it is necessary to apply two ligatures, one above and another below the division, to prevent after-bleeding, which may take place by regurgitation of the blood from the lower end of the artery. On this account, also, in wounds of the larger branches of a large artery, if the latter be tied above the wounded part, after-bleeding ensues from the quickly established collateral circulation (*a*).

[Another point in reference to taking up wounded arteries is also not to be overlooked, namely, that if that side of the limb at which the wounding instrument have entered be at a greater distance from the artery than the sound side, it is preferable to cut down upon the vessel at the uninjured part. I recollect some years ago seeing this practice adopted with great success by my friend TRAVERS. The patient had received a scythe wound on the outside of the leg, and the scythe passing across had wounded the posterior tibial artery, but did not penetrate the skin on the inside of the leg. Attempts were made to get hold of the vessel by enlarging the wound, but its depth was so great that they were fruitless. An incision was then made along the inner edge of the shinbone, and the artery without difficulty secured.—J. F. S.]

293. One end of each ligature should be cut off near to the knot, and the other taken, by the shortest course, over the edge or the angle of the wound. If this be done, no accidents, which can properly be ascribed to the ligatures, ever happen. Ligatures separate, even on the largest arteries, in from fourteen to sixteen days; on the smaller ones in a shorter space

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(*a*) BECK, über die Anwendung der Ligatur bei Schlagader-Wunden. Freiburg, 1836.

of time. If they remain longer, they are retained by the surrounding granulations, and must be separated by repeated pulling and twisting.

Cutting off both ends of the thread near the knot, as recommended especially by Lawrence (*a*), Hennen (*b*), Delpech (*c*), Walther (*d*), and others, is advantageous, inasmuch as the quick union is less disturbed, the remaining knot being either enclosed in a cellular capsule, or separated and absorbed. Numerous experiments, however (*e*), prove that re-opening of the wound, suppuration, fistulous passages, and the like, may be produced by the knots remaining; and, if the first-mentioned mode of tying the vessels have been employed, no inconvenience has been observed from the retention of small single threads, as I am convinced from repeated experience. For the purpose of helping the solution and absorption of the remaining knot, it has been recommended that the ligature should be made with softened catgut, or with the substance called by the English, "silk-worm-gut," [the silk tubes of the silk-worm containing the secretion from which the silk is spun, stretched and dried.—J. F. S.,] or with leather (*f*). Attempts to tie arteries with fine metal wire have also been made (*g*).

For special apparatus to remove long retained ligatures, see A. Lau (*h*), Kluge and von Graëfe (*i*).

[The practice of cutting off both ends of the ligature was first made public by Haire, of Southminster, in Essex, as long back as 1786. He says (*k*):—"The ligatures sometimes become troublesome, and retard the cure. An intimate friend of mine, a surgeon of great abilities, proposed to cut the ends of them off close to the knot, and thus leave them to themselves. By following this plan, we have seen stumps healed in the course of ten days. The short ligature, thus left in, commonly made its way out by a small opening in a short time, without any trouble, or the patient being sensible of pain." (p. 390.) In 1813, Hennen (*l*) says that he adopted this practice at the suggestion of one of his assistants, who believed it to have been an American invention. He treated several cases in this way, and observes:—"As no inconvenience whatever followed, nor did the small particle of silk left behind give rise to any apparent irritation, I made a favourable report of the short-cut ligatures." He adds, however, that, "of the small circles of silk, a part had come away with the dressings, whilst some had floated out on opening the little pustules which formed over the face of the stump, at the points where the arteries had been tied. Some few of the ligatures never made their appearance, and the patients complained of no uneasiness whatever." (p. 176.) Guthrie mentions that this practice was followed out successfully in the campaign of 1813; and that, in June of the following year, Delpech showed him several cases doing well at Montpellier. In this year, also, Lawrence read the paper already alluded to, advocating the practice of cutting off the threads just above the knot, and closing the wound. But latterly he does not seem to hold so closely with this practice; for, after making an observation about which it is scarcely possible there can be any difference of opinion, viz., that "in every instance where you have an expectation that the wound will suppurate, you may cut off both ends, because the knot will come away with the suppuration," he more recently says (*m*):—"If the wound, however, is likely to unite by adhesion, perhaps the safest and best method is to cut off one of the ends, and leave the other hanging out of the wound." (p. 116.)

I must confess I prefer retaining one end of the ligature, and bringing it out of the wound, to cutting off both, as scarcely ever do we desire or encourage suppuration in a wound, but take every precaution to favour adhesion. If there be an open wound, either by a portion of the skin being lost in the accident, and the edges incapable of

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(*a*) Medico-Chirurgical Transactions, vol. vi. p. 156.

(*b*) Observations on some important Points in the Practice of Military Surgery, and the Arrangement and Police of Hospitals. Edinburgh, 1818. 8vo.

(*c*) Mémoire sur la Complication des Plaies et des Ulcères connues sous le nom de Pourriture de l'hôpital, p. 29, Paris, 1815; and, Chirurgie Clinique de Montpellier, vol. i. Paris et Montpellier, 1823. 4to. Observations et Réflexions sur la Ligature des principales Artèses, p. 85

(*d*) Fraenkel, Pres. Walther, Dissert. de Laqueis Arteriarum Deligatione inservientibus prope ad nodum revinctum resecandis. Bonnæ, 1824.—Dieffenback, über das Abschneiden der Unterbindungs faden nahe am knoten; in Rust's Magazin, vol. xxiv. part i. p. 17.

(*e*) Guthrie, G. J., On Gunshot Wounds of the Extremities, requiring the different operations of Amputation; with their After-treatment. London, 1815. 8vo.—Gross; in London Medical Repository, vol. vii. p. 363.

(*f*) Jameson, J. H. G., Observations on Traumatic Hæmorrhage; in the Medical Recorder for Medicine and Surgery, vol. xi. Jan. 1827.

(*g*) Levret; in American Journal of Medical Sciences, May, 1829.

(*h*) Ueber die Lösung zu lange liegenbliebender oder eingeheilter Gefäss Ligaturen; in Rust's Magazin, vol. xxiv. part i.

(*i*) In von Graëfe and von Walther's Journal, vol. xvii. p. 339.

(*k*) Remarks on Mr. Lucas's Practical Observations on Amputation; in Simmons' London Medical Journal, vol. vii. 1786.

(*l*) Principles of Military Surgery. 2nd Edit. Edinburgh, 1820. 8vo.

(*m*) Lectures; in Lancet.

being brought together, or if, in a sloughing sore, an artery be opened by ulceration, then both ends may be cut off without hesitation; but otherwise it is best to retain one, were it only that its separation proves that another cause may produce the fistulous passages which occasionally form in wounds, of which, perhaps, nearly the whole, excepting these, has healed quickly and kindly.

The employment of silk-worm gut was first proposed by Dr. M'SWEENY, of Cork, Ireland (*a*), that of leather, or the *animal ligature*, consisting of chamois leather rolled, was recommended in 1814 by PHYSICK, of Pennsylvania, who, according to Dr. REESE (*b*), thinks that, as it is "made of animal matter, the knot, which is all that is left in the wound, will serve long enough to obliterate the artery, and be speedily removed by the absorbents, thus avoiding the difficulty arising from a foreign body, however small."

ASTLEY COOPER had at one time a fancy for catgut ligatures; he says (*c*):—"Catgut, employed as a ligature, being more of the nature of the animal matter in which it is embedded, will be more easily absorbed than silk, or, if even not absorbed, will be less likely to excite irritation in the parts." (p. 126.) He tied the femoral artery, in a case of popliteal aneurism, with this substance previously soaked in water heated to 100° Fahrenheit, cut off both ends, and closed the wound with adhesive plaster; on the fourth day after the operation the wound was completely united; in three weeks he walked about the ward with a crutch; no kind of untoward symptoms appeared, and he was perfectly cured by the fifty-fourth day. This practice may have been pursued with two or three cases, but was soon given up, though I do not recollect for what reason. I have also an indistinct notion of COOPER having on one occasion used an isinglass ligature, but I have not any note on the subject to refer to. He, however, commonly used Dutch twine.

The material now generally employed is silk of various thickness, according to the size of the artery to be tied. It should be well twisted and round, and should be slightly waxed when used.

As regards the time required for the separation of ligatures, it is very various, and may depend on the constitutional powers of the patient, or on accidental causes. I have known a ligature on the femoral artery come away in ten days; but in the last case of popliteal aneurism on which I operated it did not come out till the fortieth day. My friend CALLAWAY tells me, that very recently, in a similar case, he has withdrawn a ligature four months after its application; and my friend GUTHRIE, that a short time ago he had pulled away a ligature from the brachial artery which had remained four months after amputation of the arm. There is also in the museum of St. Thomas's a preparation of a ligature which had been applied to the femoral artery, and remained in the stump, I cannot exactly say upon the artery, till death, six months after.

Sometimes the ligature has been allowed to remain for many weeks in consequence of the agonizing pain produced when even very gently pulled. In such cases it may be presumed that a nerve has been included in the ligature, as happened with a a patient of CHOPART'S, in which it remained till death; and the parts are in our museum at St. Thomas's. The like untoward accident befel our celebrated naval hero, Lord NELSON, whose arm was amputated at the attack on Teneriffe; the ligature was retained several months, and caused him violent agony, but was at last removed by Dr. BEATTIE.

Occasionally it happens that the artery is not perfectly sealed up after the application of a ligature; and when the thread begins to ulcerate the vessel begins to bleed: this occurred many years ago, in a case in which my friend GREEN tied the subclavian artery for axillary aneurism. On the *fourteenth* day after the operation, an arterial bleeding to the amount of a pint occurred from the wound; it was, however, stopped by a quarter of an hour's firm pressure, after which cold wet linen was applied, no further bleeding ensued, and on the *twenty-seventh* day the ligature came away. The wound healed, except a small sinus from whence there was only a slight discharge, which continued open. From this about midnight of the 31st of October, exactly *thirteen weeks* after the operation, a sudden jet of blood occurred whilst he was asleep, but was easily stopped by pressure. On the following evening, whilst he was voiding his water, the arterial bleeding again recurred in a jet and as large as the aperture of the sinus would permit. Pressure, however, soon checked it, and, after having been kept for an hour was withdrawn and cold wash only applied. He slowly recovered without further accident. This, although an extreme and very uncommon case, is a good example of the advantage of leaving the parts at rest and undisturbed, if the hæmorrhage can be stayed

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(*a*) Edinburgh Medical and Surgical Journal, vol. xiv. p. 18.

(*b*) REESE and JAMIESON'S Edition of SAMUEL COOPER'S Dictionary.

(*c*) On the Ligature of the Aorta; in his and TRAVERS' Surgical Essays.

by pressure and cold lotions. Had the ligature been pulled about in the first instance, fatal bleeding would most probably have occurred, as it would have been impossible to have done other than tie the *arteria innominata*, a favourable result from which could scarcely be expected under the circumstances. What the actual condition of the artery was throughout the course, of the case was not ascertained, as the patient still lives, but it seems likely that it had assumed such a state as that which will be presently (p. 315) adverted to in some cases under the younger CLINE.

I believe the safest and best plan is, generally speaking, to leave the ligature to be ejected from the wound by the suppurating process. It should never be pulled violently till some weeks after it has been applied; nor should it ever be jerked under the notion of favouring its abstraction The degree of its fixity should be daily ascertained by steady and gentle pulling; if it yield, it may be presumed to have separated from the vessel, though such is not always the case, as a coil of the thread may have remained accidentally in the wound, and unwinds by the pull; but if the ligature continue to follow the draught upon it, usually it can be withdrawn. If it will not come out forthwith it must be left, and the same practice repeated daily till it does come out. Sometimes the thread has not ulcerated through the vessel, of which the obliteration is not completed in the usual time, and then, if the ligature be violently dragged, secondary bleeding will ensue; or the ligature may have separated, and its knot be entangled by the granulations around it. This obstacle is commonly soon overcome by absorption of the granulations between the knot and the skin, and may be usually waited for without inconvenience to the patient. It must not therefore be supposed that if the ligature do not come away, it is necessarily still around the artery, which is generally not the case.

Some surgeons, when a ligature has been long retained, pass a probe by its side, as low as it will descend, and then twist thread and probe round till both come away together. But I prefer the younger CLINE'S practice of putting a thin whalebone spring upon the thread, the constant pull of which upon the knot makes it press against the obstacle which prevents its coming away, and produces ulceration, which sets it free often in the course of the day; but if not, the thread must be daily twisted on the spring, so as to keep it tight till it comes away. Another method is to roll the thread close up to the wound, on a bit of bougie or wood, and prevent its uncoiling by fixing it with adhesive plaster, but the former plan is preferable.—J. F. S.]

294. *Torsion*, or the *twisting of arteries*, (*Torsio Arteriarum*,) distinctly mentioned of old by GALEN (*a*), has, in modern times, been proposed, and proved by experiments on animals, by AMUSSAT (*b*) and THIERRY (*c*), as a safe mode of stanching the bleeding from arteries. LIBER (*d*) has repeated the same experiments in Germany. VELPEAU first used torsion on the human subject. AMUSSAT, FRICKE, DIEFFENBACH, and others, have made numerous experiments of the kind (*e*).

295. The changes produced by the torsion of arteries are, 1st, the inner and middle coats of the arteries are circularly divided or torn for some lines above the opening of the vessel, they approximate and shrink away from the cellular coat, and, by retracting into the canal, form a blind sac or valve, which may be called the *inner valve ;* 2nd, an *external valve* (like a monk's hood) is formed out of the above-named cellular coat, which completely closes the mouth of the artery; 3rd, a blood-clot is invariably formed, which fills up the cavity of the artery; 4th, inflammation and plastic exudation taking place in the torn inner and middle arterial coats, closing the mouth of the artery, and its walls which touch each other become united; 5th, suppuration and ulceration may, indeed, occur in the arteries in question, but hitherto they have not been noticed, neither are they, in any case, necessarily connected therewith; 6th, the canal of the

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(*a*) GALEN (Meth. Medic. lib. v. cap. iii. p. 318. Edit. KÜHN) says, on this point: *καὶ πότερα φλὶψ, ἢ ἀρτηρία ἐςί μὲτα δὲ ταῦτα διαπήιρας ἀγκίςρῳ ἀνατεινέτω τε καὶ περιςτρεφέτω μετρίως.*

(*b*) Archives Générales de Médecine, vol. xx. Aug. 1829, p. 606.

(*c*) De la Torsion des Artères. Paris, 1829.

(*d*) HECKER'S Annalen, vol. xv. p. 185–196. Feb. 1830.

(*e*) SCHRADER, Dissert. de Torsione Arteriarum. Berol., 1830. 8vo.—VELPEAU, Mémoire sur la Cessation spontanée des Hémorrhagies traumatiques et les moyens, qui dans quelques cas pourraient servir des succedanes à la ligature des artères; in the Gazette Médicale, vol. i. No. 48. Nov. 1830.

artery grows together up to the next collateral branch, and is converted into an impervious thread. In these changes, produced by torsion of arteries, perfect accordance with those produced by ligature is observed. If the torsion be not sufficient, the knot may untwist itself, and bleeding take place. By its proper contraction and also by its shortening, produced by the torsion, the artery is retracted into the soft parts, which offers some obstacle to the flow of blood, although at every pulsation it is somewhat projected.

[In speaking of the suppression of hæmorrhage, JOHN HUNTER makes some observations which may here be very suitably introduced as bearing on the subject of torsion.

"Another mode of suppressing hæmorrhage," says he (*a*), "arises out of the natural, and may be considered in some degree as natural. It is a property in flexible bodies to have their diameters contracted as they are lengthened; in arteries this might be carried to a great degree when permanent effects are to be produced. It is necessary that they should be lengthened so much as to destroy the contractile power; for this is the way Nature takes to stop the bleeding of ruptured vessels. Thus we see that arteries which are lacerated will more readily stop bleeding than if cut with a sharp instrument, as was proved in the case of the miller related by CHESELDEN, and this is the way nature takes to stop the bleeding of the navel string in beasts. Surgeons do not take advantage of this; but farriers and gelders do, as their practice of tearing the artery through, in gelding animals, shows."

Upon this PALMER observes (*a*):—"The principle of torsion, as practised by several of the French surgeons, is precisely the same as that which is here laid down in respect of lacerated arteries; that is, the extremity of the artery is drawn to a point, and does not return to its original calibre, in consequence of the destruction of its elasticity. We may also further add that the rupture of the internal and middle tunics, which generally happens on these occasions, will tend to occlude the mouths of the vessels still more completely by entangling the blood among the lacerated fibres, and promoting its coagulation. But how far the first of these effects, or the obliteration of the calibre of the vessel, depends on the destruction of any vital property, as of muscular contractility, may well be questioned, since the same effect takes place on dead arteries when similarly treated." (pp. 539, 40.)]

296. Various methods of using torsion have been proposed.

According to AMUSSAT, the artery should be taken hold of, and drawn out five or six lines above the surface of the wound, by forceps of suitable breadth, and furnished with an apparatus for closing them; the vessel is then to be separated from the surrounding parts with another pair of forceps which have rounded and rough points, or with a small knife, so that it may be entirely isolated. At the point where the artery still remains in contact with the soft parts, it is to be seized and fixed with the second pair of forceps, or with the fingers of the left hand. The artery is then to be turned round upon its axis until the end is torn off, when the bleeding is certainly stopped. Below the fixed part no blood is found in the canal of the artery. If no forceps be at hand, the artery, in pressing cases, may (as was proposed by GALEN) be pierced with a needle or with a nail, and so twisted round.

THIERRY seizes the artery with a pair of broad forceps which shut close, but neither fixes the vessel nor draws it out. In small arteries four, in larger six, and in the largest ten turns may be made, without going so far as to tear the vessel through.

According to FRICKE, the artery should be gently drawn out six or seven lines, but not fixed, so that the twisting may not extend to the part where the artery is still connected with the other parts. The artery thus held should be separated by another pair of forceps from the surrounding parts. For holding the vessel FRICKE employs a pair of simple forceps,

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(*a*) Lectures; PALMER's Edition.

the fine teeth of which do not lock into, but only meet, each other, and furnished with a stud at the upper part of one limb, which, on pressing the forceps, fits into a hole in the other limb, to prevent its slipping sideways. In twisting, the fingers of the left hand must be so placed on the limbs of the forceps that they move as if in a ring. The twisting should be continued till a piece of the artery is torn off, for which, usually, eight or nine twists are necessary; we may then be sure that the external valve is formed, though not so if we only give a certain number of turns, after Thierry's mode of proceeding. In the smaller arteries, a certain number of turns may be made, according to their size, or the turning continued till the artery is torn off.

Dieffenbach uses the same kind of forceps as Rust, except that they are rather broader. Kluge has proposed a peculiar apparatus, by which the twisting of the artery upon its axis is effected, by means of a spiral feather attached to a pair of forceps (*a*).

297. Experience has, up to the present time, sufficiently proved that by torsion, bleeding may be with certainty stanched, even from the largest vessels. The advantages derived from torsion, in comparison with the ligature of arteries, are, that, as in torsion, no foreign body remains in the wound, the quick union ensues more certainly than in ligature, in which the remaining threads, whether cut off or drawn over the edge of the wound, act as foreign bodies retarding that process; and that in sudden accidents the surgeon can effect the torsion of arteries alone, and without assistance. These circumstances do not, however, seem to me sufficient to decide the question upon the absolute preference of torsion over ligature. In reference to quick union, Dieffenbach (*b*) has raised a doubt, whether the knot made in the artery should not also, to a certain extent, be considered as a foreign body, in a wound to be healed by *prima intentio;* whether it may not produce suppuration in its immediate neighbourhood, although, as shown by experiment, it unites immediately with the neighbouring parts; and whether, on account of the quick union of the torn and twisted trunk, it may not the more easily suppurate, and after-bleeding take place. In cases of torsion of arteries which have come under my notice, in simple wounds especially disposed to quick union, namely, in those of the face, the result was not in favour of torsion, inasmuch as suppuration followed it more commonly than after ligature of the vessels. Pulling out the artery, to the extent of six or eight lines, disturbs, in the large arteries, their connexion with their sheath, up to the next collateral branch, and produces injurious consequences. This is not, however, to be feared in the smaller arteries. By the tearing and bruising of the arterial coats in torsion, separate fragments of the coats die off, and suppurate. In an artery wounded near a large collateral branch, torsion is always less to be depended on, because here the necessary space for the formation of the blood-clot is diminished by the knotting of the artery (*c*). The second advantage, namely, that torsion can be performed without assistance, is still important: however, here also it is to be borne in mind, that, with the close-shutting forceps, the ligature may usually be applied without the aid of assistants with little difficulty. On the other hand, it is not to be overlooked, that, whatever dexterity a person may possess, it is commonly very difficult to take hold of arteries which run in thick cellular tissue, to

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(*a*) Compare Rust's Handbuch der Chirurgie, vol. ii. p. 291. Koch's Forceps; in von Graëfe and Walther's Journal, vol. xxvi. part iii. p. 496.

(*b*) In Rust, just cited, p. 287.

(*c*) Above cited, p. 30.

draw them out, and to isolate them from surrounding parts; and that deep lying arteries, which can be taken hold of only with great trouble, may, in general, be more easily secured by ligature than by torsion. The pain is usually about the same in both proceedings; but in those cases where it is difficult to draw out and isolate the arteries, torsion must always be the more painful operation.

Dupuytren (*a*) asserts that, according to the experience of distinguished practitioners, the consequences of torsion are inflammation and suppuration along the sheath of the vessels; that it is often insufficient; frequently, from many circumstances, impracticable; and that, after fruitless trials, the ligature must be made. **Lorch** (*b*) denies the bad results which torsion effected in various cases of **Delpech's**, and does not believe that suppuration in the sheath of the artery can be ascribed to it. Just so does **Textor** (*c*), but especially **Fricke** (*d*), who, by numerous experiments, sufficiently proved the importance of torsion, and has set aside many groundless objections to it. Compare also, **Elster** (*e*), **Bramberger** (*f*).

[I have never employed torsion, and, not being convinced of its having any preference over ligatures, do not think it probable I shall resort to it; but the objections made to it by **Dieffenbach**, **Dupuytren**, and **Chelius**, are not to me very satisfactory. The safety of torsion can scarcely be denied, even if reference only be made to **Ferne's** remarkable case, in 1737, mentioned by **Cheselden** (*g*), in which "the arm of a miller, together with his scapula, was torn off from his body by a rope winding round it, the other end being fastened to the cogs of a mill. The vessels, being thus stretched, bled very little; the arteries and nerves were drawn out of the arm; and the surgeons first called placed them within the wound, and dressed it superficially. Next day he was taken to St. Thomas's Hospital, but the dressings were not removed for some days. The patient had no severe symptoms, and the wound was cured by superficial dressings only, the natural skin being left almost sufficient to cover it." (p. 321.) We have also in St. Thomas's Museum an example of torsion of the femoral artery, accidentally effected by the coil of a cable, into which a sailor had stepped, being unwound by lowering the anchor, and tearing off the limb through the middle of the thigh; in this case, as probably in **Ferne's**, the cellular tissue is dragged beyond the torn end of the vessel for an inch at least, and twisted round, so that the vessel and tissue together resemble a long narrow cone. No hæmorrhage followed, and the man was brought to Guy's Hospital, where amputation above the injured part was performed by **Astley Cooper**, who was accustomed to mention the case in his lectures.—J. F. S.]

298. After this review of the advantages and disadvantages of the torsion of arteries, an absolute preference can only be given to it in those cases in which it is very important that no foreign body should be left in the wound, as in injury to the epiploic, mesenteric arteries, and the like. In inflamed, bony, or otherwise degenerated arterial coats, torsion has a satisfactory result as rarely as ligature, although **Köhler** (*h*) asserts that even bony vessels may be twisted with good effect, which **Fricke** (*i*) has confirmed by experiment. Of the various modes of applying torsion that proposed by **Fricke** is to be preferred.

299. As a means of stanching bleeding from wounded vessels, the *interweaving of vessels*, recently proposed by **Stilling** (*k*), is yet to be mentioned, in which the divided end of an artery is passed through a cleft formed in its own walls, and is so closed that no blood can flow out. The vessel is to be somewhat drawn out with forceps, the surrounding cellular tissue divided or thrust back, and compressing forceps applied at a distance from the edge of the artery, which is more than twice the diameter of its

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(*a*) Leçons Orales, vol. iii. p. 464.

(*b*) **Rust's** Magazin, vol. xxxvii.

(*c*) **Froriep's** Notizen, No. 723, May 1831.

(*d*) Annalen der Chirurg. Abtheilung des allg. Krankenhausen in Hamburg, vol. ii. p. 150.

(*e*) Comment. de Arteriarum Torsione, Göt. 1832.

(*f*) Ueber die Torsion der Arterien; in **Horn's** Archiv., 1835, part i. and ii.

(*g*) Anatomy of the Human Body, 11th Edit., 1778.

(*h*) **Hecker's** Annalen, vol. xv. p. i.

(*i*) Above quoted, p. 164.

(*k*) Die Gefäss durch schlingung, eine neue Methode, Blutungen aus grösseren Gefässen zu stillen. Marburg, 1834.

area. The vessel is to be laid hold of transversely close to its edge, is to be a little flattened, and the point of a lancet-shaped knife is to be thrust (according to the size of the vessel) at a distance of half or a whole line from the lateral edge of the flattened artery, and at a distance from its aperture equal to its breadth, parallel to the axis of the vessel through its upper wall, and pushed through it and the under wall, so that a bridge is formed, the length of which is equal to the diameter of the artery. In withdrawing the knife, the cleft in the lower wall which, on account of the converging edge of the knife, is somewhat shorter than that in the upper wall, is to be carefully lengthened; a pair of close *interweaving forceps*, answering to the size of the cleft, is to be carried from the under wall through both clefts, so that, according to the size of the artery, the instrument projects from one to three lines out of the upper cleft The other forceps may now be withdrawn. The interweaving forceps are next to be somewhat opened, and, by means of a probe-shaped instrument which enters one or two lines deep into the tube of the artery, an attempt is made to bring a fold of the cut edge of the end of the artery between the open branches of the interweaving forceps, by bending the end of the artery backwards over their upper surface, and, at the same time, thrusting between them the end of the vessel. As the probe-shaped instrument is withdrawn, the forceps are closed, and the end of the artery which they hold is drawn into the double cleft. The compressing forceps may be now laid aside, the end of the vessel held by the interweaving forceps drawn backwards, and, if no bleeding follows, these also may be removed. The processes after interweaving agree with those which follow after ligature and torsion. The vessel, besides, must be more than a line in diameter, and easily accessible to the eye and hands. STILLING has also proposed interweaving for the veins: his experiments have, however, been only made on beasts and on the dead human body.

300. The *astringent styptic remedies*, turpentine, kreosote, tannin, employed to stanch bleeding, produce more rapid contraction of the extremity of the artery, and, perhaps, a quicker coagulation of the blood. To these belong cold water, brandy, THEDEN's arquebusade, alum, blue vitriol, and so on. The colder these remedies are applied, the more powerfully do they act. They may also be employed in the form of powder, in which case they seem to close the mouth of the vessels mechanically, as gum kino, gum arabic, colophonium, and so on. Their action, especially as they are most commonly accompanied with pressure on the wound, is always injurious to the healing: they increase the inflammation, prevent the quick union, and are not preservative against after-bleeding. Their use, therefore, is confined to bleeding from small vessels, from mucous membranes, and to so-called parenchymatous bleedings. According to the experiments made upon beasts and men by VON GRAEFE (*a*) with BINELLI's water, a wad of linen soaked in it, and pressed against the wounded surface for five or ten minutes, will quickly and permanently stanch bleeding from both small and large vessels, (even from the femoral artery in amputation of the thigh, and from the carotid in a horse,) without any other assistance, without the least pain in the wound, without discoloration of its surface, without the production of a slough, and without any local or general inconvenience. Examination

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(*a*) Journal für Chirurgie und Augenheilkunde, vol. xviii. p. 2, vol. xvii. p. 650, vol. xxvi. part iii. p. 505. MAUROCORDATO, über die dynamische Wirkung des BINELLI'schen Wassers. Würzburg, 1830.—SIMON, Diss. de Aquæ BINELLI et Kreosoti virtute stypticâ, Bero[illegible] 1833, assigns to it, from experiments, scarcely more influence than cold water.

of the vessel, the bleeding from which has been thus stanched, presented its mouth completely closed by a clot, which extended up to a considerable distance. The chemical examination of this water has hitherto discovered, besides a slight empyreuma, no very active substance, viz., neither alkalis, acids, salts nor metals; and there is no doubt that the active principle is kreosote, and that kreosote water acts in the same manner. Unfortunately, neither the experiments of other persons nor my own with Binelli's or with kreosote water, have had any satisfactory results.

301. *Cauterization*, that is, the application of a hot iron upon the mouth of a wounded vessel, produces a slough, which closes the opening in the vessel; a clot forms in its cavity, and plastic exudation is the result of the inflammatory process by which the coats of the artery are united. As the slough may separate too quickly, and the bleeding recur, (for, after the application of the heated iron, profuse suppuration always occurs,) its use must be restricted to those cases in which the blood flows from many small vessels which cannot be tied, or where styptic remedies and compression are insufficient; for instance, in severe bleedings, after operations in the mouth. The other remedies formerly employed for stanching bleeding are to be entirely rejected.

302. When the bleeding is stanched, the surgeon must be particularly careful to prevent its recurrence (after-bleeding.) The patient must be kept very quiet; he must, in important cases, be watched by intelligent assistants, especially if the sympathetic fever should be very severe. If after-bleeding take place, it must come either from vessels which had not been tied, or on which the ligatures have become loose, or from the whole surface of the wound where no vessel can be perceived. It depends upon the extent of the after-bleeding whether the stanching is to be attempted by the application of the tourniquet, the compression of the wound, the use of cold water, or by loosening the dressings and tying the vessels. In severe inflammatory fever, the bleeding often ceases after a large blood-letting, and the use of cold applications to the wound. Bleeding in the subsequent course of the wound occurs either from the too early loosening of the ligatures, from ulceration of the arteries, or from a debilitated condition of the vessels, and a disposition to fluidity in the blood. In the former case, it depends on the more or less advanced state of healing of the wound, and the size and situation of the vessels, whether they are to be tied in the wound, whether pressure and styptic remedies are to be applied, or whether the principal trunk of the artery is to be secured above the wound. In the latter case, local styptic remedies, pressure, even the use of the actual cautery (1), or tying the trunk of the vessel above the wound, are proper; and a strengthening treatment, combined with acids, suitable to the general state of the constitution (*a*).

After-bleeding readily occurs, if the ligature be placed close beneath a large collateral branch, as also in morbidly changed arterial coats, in which ulceration readily takes place. If the arteries have become bony, the safest way to guard against bleeding is to insert a linen cylinder into the mouth of the artery, and to apply (not too tightly) a broad ligature around it (2), as mentioned below, (p. 318,) or to use torsion (*par.* 298.)

[(1) The subject of after or secondary bleeding is of so great interest to surgeons, and of so serious consequence to patients,—not whose limbs only, but even whose life depends upon its proper and prompt treatment,—that I feel no need of apologizing for the introduction of the following clinical observations made many years since, by the younger Cline, on two cases which were under his care. These have never been published, and as I have the good fortune to possess notes, I avail myself of the opportunity to

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(*a*) Heidelberger klinischen Annalen, vol. iii. p. 337.

insert them here, believing them interesting and valuable, as having been treated with a different view of the operation of the actual cautery to that generally held. I wish, also, to put forward the just claim of my esteemed and skilful master (whose early death removed him from a course of professional usefulness to the great establishment of which he was one of the surgeons, and to the students by whom he was attended, and deprived the profession of one of its most able and upright members) to the re-employment, at least in England, of, in many cases, that invaluable remedy, the actual cautery; which, like numerous other remedies of Ancient Surgery, had been thrown aside in consequence of its abuse, and of the fondness for new remedies which, in our profession, is by no means uncommon.

CASES OF AFTER-BLEEDING IN WHICH THE ACTUAL CAUTERY WAS EMPLOYED, AND CLINICAL OBSERVATIONS THEREON, BY HENRY CLINE THE YOUNGER.

CASE 1.—G. G., aged twenty-eight years, a post-boy, was admitted into St. Thomas's Hospital, *Jan.* 24, 1815, with a compound fracture of the left leg, caused by the wheel of his carriage passing over it, he having slipped whilst getting on the bar, and fallen beneath. Both bones were broken, but did not protrude through the wound, although they evidently communicated with it. The edges were brought together with adhesive plaster, and, the limb having been placed in splints, an evaporating lotion was applied. On the 27*th*, as his bowels had not been relieved since his admission, and, as febrile symptoms had appeared, he was ordered a dose of infusion of senna and sulphate of magnesia immediately, and fever mixture with three drops of laudanum every six hours. Up to this time the case was going on well, but the medicine produced seven or eight stools next day, and at the visit on the 29*th* he had passed eight or nine more. The result of the necessary frequent movements appeared this morning in the violent inflammation with which the limb had become attacked, accompanied with gangrenous vesication. Chalk mixture, with aromatic confection, was ordered; the purging continued, however, through the night, but on the following day, *Feb.* 1, it was checked. He had a quick pulse, white but not furred tongue, and good appetite. The leg was now extensively inflamed, and suppuration having commenced, a poultice was applied. Early on the following day his bowels were again disturbed ten or twelve times; sloughy ulceration had occurred above the outer ankle, and on the 4*th Feb.* another slough upon the instep; and a piece of the shin-bone being loose, was removed. The discharge was very great and offensive. The fever mixture was continued, a grain of opium given nightly, and rhubarb bolus twice a week. The limb, which to this time had been on the side, was now placed on the heel with the knee bent, in a thigh-fracture box, and the poultice continued. This position, however, was not comfortable, and next day the limb was taken from the box, and on the day following put in a leg-fracture box, which suited well. On the 9*th Feb.* it was thought advisable to improve his living by giving some porter, but, as in the course of the day there was a little bleeding from the wound, it was not continued. He, however, went on well till the 15*th*, when a patient falling over the bed jarred his leg, and bleeding from the wound ensued to the amount of six or eight ounces. On the 21*st* a sympathetic abscess in the groin was opened. His constitution continued fighting with the ailment, but another piece of bone was discharged, and the lower end of the shin-bone protruded considerably through the wound. His powers at last began to fail, and amputation, which could no longer be avoided, was performed, on 9*th April*, above the knee, by my friend TRAVERS, whose patient he had become by the death of the surgeon under whom he had been admitted. Three ligatures were applied, and he went on exceedingly well, improving in health daily, till the evening of the 29*th*, when a severe arterial bleeding, to the amount of a pint and a half, occurred; the ligatures had come away on the 16*th*, but that on the femoral artery still remained. The bleeding continued through the following day, and although the tourniquet had been applied, he lost three pints of blood within the twenty-four hours. A solution of sulphate of copper was applied to the surface of the stump, and cold wet cloths over it, and the bowels cleared with castor oil.

May 1, 1 P. M. Free bleeding to the amount of a pint took place; at *half-past two*, another pint, and smaller quantities continued to flow till 11 A.M., when eight ounces more escaped. Six grains of powdered digitalis were given in divided doses before 8 A.M., which reduced the pulse considerably, but without arresting the bleeding, though he had become very weak and covered with clammy sweat. Ten drops of laudanum every six hours were then ordered, but he continued in a very unsatisfactory condition, and vomited twice in the course of the morning (*a*).

(*a*) Thus far is from the dresser's and my own notes, but the remainder of the case is from my master's narrative.—J. F. S.

At 4, P.M., his surgeon being ill, I was requested to see him. On removing the coagulum, a ligature was found and withdrawn; the blood flowed from a sinus which would admit the finger, and up this a piece of sponge was introduced, the tourniquet taken off, and the stump kept cool with GOULARD'S wash. A grain of superacetate of lead was ordered at 5, P.M., and to be repeated at 6, P. M. The vomiting soon after returned, and continued during the evening; but he got a little sleep.

May 2, 1, A.M. The sponge having slipped out, was replaced; but bleeding did not return, and at noon it was removed. A small quantity of sulphate of magnesia was given to produce a stool, and a drachm of powdered sarsaparilla ordered twice a day. In the course of the afternoon he had a little wandering, but it soon went off. Under this treatment he continued improving till

May 23, when another profuse bleeding (the dresser says to three pints) took place. Finding the end of the stump much swollen from the pressure of the tourniquet, which had been put on to check the bleeding, I removed it, and adjusted the pad of a small truss upon the inner side of the thigh near the end of the stump, with a view to compress the sides of the artery, and at the same time permit the blood to pass through the small arteries, and allow its return by the veins, as well as that of the lymph by the absorbents. This plan succeeded, till

May 26, 11, P.M., when the pad probably having slipped, another severe bleeding ensued, to the amount of two pints. The tourniquet was used, but without effect, and the bleeding could only be restrained by great pressure of the dresser's thumb, as the arterial action was very strong. An injection of strong solution of alum was thrown up, but without benefit, and gave much pain. He was much exhausted; and his pulse 120, and irritable. A grain of acetate of lead was given, with twenty drops of laudanum, at midnight, and

May 27, 1, A.M., it was repeated; but the arterial action and bleeding continued.

5, A.M. I was called to him; and the means hitherto employed having failed, I determined to apply the actual cautery, by passing a hot iron up the bleeding vessel. With this view, the sinus from whence the blood flowed, together with a part of the end of the stump, were slit up; and it then appeared that the sinus was the end of the artery in a diseased state, resembling the structure of an aneurismal sac, when the whole cylinder of the vessel is enlarged. This aneurismal condition extended from the face of the stump upwards about two inches, and was large enough to admit the thumb; above this the vessel was sound. A canula was then passed up to the distance of three inches, so as to enter the healthy part of the artery, and into it a hot iron was introduced, with which the coats of the artery were burnt, in hope of producing inflammation and consequent adhesion. The cauterization gave great pain, but immediately arrested the bleeding. The canula was left in the vessel, which, shrivelling up, had become adherent to it. He began speedily to improve, and, with the exception of one slight bleeding, did well; and was discharged.

Aug. 10. Perfectly well.

CASE 2.—G. M., aged about twenty-five years, was admitted

Feb. 11, 1819, with an affection of the left knee, of long continuance, from which his health has suffered much. A fortnight ago an abscess of considerable size had formed on the inside of the knee, and burst. He was advised at once to submit to the loss of his limb, on account of the exhausting effect of the disease on his constitution.

Feb. 19. The leg was amputated above the knee in the usual manner, and three ligatures applied. *Two* hours after, his pulse was quick and throbbing, and slight bleeding occurred from the stump, which was then covered with cold lotion, but without advantage, as the bleeding increased; and in *three* hours' time had become so profuse, that it was necessary to remove the dressing, open the wound, and clear away the clot, which being done, a small artery was found and secured, and the bleeding ceased.

Feb. 24. Has gone on well: part of the dressings were taken off, and replaced; there is a slight discharge, but no appearance of adhesion. On the following day the rest of the wound was dressed, and the ligature last applied came away.

Feb. 28. Was requested to visit him on account of a return of the hæmorrhage, and ordered the stump to be kept cool: pulse 140, and full; he has a troublesome cough. The wound has begun to granulate.

At 5, P.M. As the bleeding was still free the dressings were removed, and attempts made to secure the artery, but in vain, as it had retracted very much. The patient soon became faint, and the bleeding then ceased.

March 1. He appeared weak from the loss of blood, but hæmorrhage had not recurred. His cough still remains troublesome.

March 3. This evening a fresh bleeding having come on, ASTLEY COOPER endeavoured to secure the vessel with a needle and ligature, but as the bleeding ceased before this could be effected he did not persist.

March 5. Again very profuse bleeding, which was stopped by the application of some styptic.

March 9. As fresh hæmorrhage had taken place the bleeding vessel was sought for, found near the sciatic nerve, and the actual cautery then applied by CLINE, which immediately stopped the flow of blood. In its application he did not complain of any pain.

Since that time he had no repetition of the bleeding, continued to improve in health, and during the course of the month was able to sit up, and ultimately recovered.

Clinical Observations.

In order that my intention in applying the actual cautery, in the cases just mentioned, may be understood, I shall make some remarks on after-hæmorrhage, commonly so called, and on the use of the actual cautery in cases of hæmorrhage after operations or other injuries.

By after-hæmorrhage is meant a bleeding that takes place when the wound has been closed up and dressed, and the patient put to bed; and it may happen at various periods after the operation. Such occurrence is particularly painful and alarming to the patient, as parts require to be disturbed which are in a state of inflammation, and if the bleeding be some hours after the operation, the inflammation is considerable, and the pain greater than when the parts are uninflamed. These cases are also very anxious and harassing to the surgeon; for, as he is unaware of the time of the occurrence of the hæmorrhage, the patient may die in his absence. I do not purpose entering into all cases of after-hæmorrhage, nor into those which, coming on two or three hours after the operation, are generally stopped by removing the coagulum and all extraneous and irritating matter except the ligatures, and exposing the face of the stump to the air, applying cooling lotions, and paying attention to the state of the bowels, but only to those cases which occur during the healing process, are obstinate, and very much reduce the patient.

Eight or nine years since, this subject passing through my mind, and reflecting upon it, it seemed to me that those bleedings arose in consequence of the want of adhesive inflammation; that instead of an effusion of coagulable lymph, an ulcerative process commenced, and perhaps I might say that the ulcerative inflammation succeeded the application of the ligature instead of the adhesive. Now, from what one observes to follow the application of a high temperature to living animal bodies, it seemed to me that the actual cautery would be most likely to bring on quickly the adhesive inflammation, just as in a scald or burn, though serum is thrown out so as to resemble a bladder of water, yet flakes of coagulable lymph are seen floating about in it. I therefore at that time applied the actual cautery to the carotid artery of a dog.

As regards the case of J. G., it may be asked what effect could sarsaparilla have in checking hæmorrhage? to which I reply, I gave it from having observed that it has considerable power in tranquillizing the arterial system; and hence conclude that if it relieve the thrilling and throbbing of the pulse, the irritability of the arteries, and produce in their extremities a healthy action, independent of its improving the general health, we may consider it an auxiliary in stopping the hæmorrhage. But I do not mean to say that when taken into the circulation it has any chemical operation in producing this effect. When I saw the patient on the 27th of May, I found the dressers alternately relieving each other in compressing the artery, and with which they had been occupied during the whole night, as nothing could be done with the tourniquet. I thought it extraordinary that the tourniquet would not stop the bleeding, and therefore myself put it on, carefuly placing the pad upon the artery, and then screwed it up, using as much force as I thought safe, taking care to avoid such as would crush the muscles, which might be easily done with so powerful an instrument, but the bleeding continued, and I therefore determined to use the actual cautery.

Having first cauterized the aneurismal part, as I have called it, of the artery, which caused no pain, I then passed the canula up into the sound part of the vessel, and as soon as the red heat had to the eye subsided, the cautery iron was run up the canula, which caused extreme pain, along the artery and its accompanying nerve, as much it seemed as the circular incision in amputation. The object of using the canula was to conduct the hot iron up to the spot to be cauterized; otherwise, as soon as it touches the vessel it is stuck fast, and you cannot pass it further up. Besides, if this did not happen, few have so good an eye and so accurate a hand as not to miss so small an orifice as that of the artery; which, however, does not occur if the canula be used.

During the progress of the case I was asked why I did not slit up the sinus, and tie the artery again. But if it did not heal when one ligature was applied, it was highly probable it would not if a second were put on. I was also asked, whether I would not tie it as in tying the artery above for aneurism. But then we should have still been in the neighbourhood of the diseased part: the same accident would have recurred, and probably the vessel would have bled again by anastomosis. To prevent this bleeding it was that I cauterized the aneurismal structure, for the purpose of producing a change in the action of the vessels.

This case presented to me a new view of the subject, hæmorrhage. It appeared the cause of the bleeding originated in a new structure being built up, whilst the artery was enlarged by absorption, so that a sort of aneurism was found at its extremity. I do not mean that sort of aneurism in which one side only of the vessel becomes diseased, but where a general circular dilatation takes place. This explains my reason for not applying a ligature upon the vessel, for had it been put on it would have given way: just as would an aneurism, if a ligature could be passed around it. The enlargement of the extremity of the artery is similar to what occasionally happens after bleeding from the temporal artery; you puncture the vessel, take as much blood as you wish: but, expecting to require more in a day or two, you do not divide it, but apply a compress. A spurious aneurism soon follows, and is occasionally accompanied with a sinus, from which repeated and obstinate hæmorrhages occur. Four or five years ago I saw a man in Guy's Hospital bleeding from a sinus, with which the dressers had been harassed night and day making pressure with the thumb on the vessel, which seemed to be the commencement of such a case as I have described. It appears to me, therefore, that the advantage of using the actual cautery consists in changing the action of the part, and rapidly inducing the adhesive inflammation.

After the employment of the actual cautery in after-hæmorrhage, pressure should be made on the artery with a tourniquet, with the finger, or with the pad of a truss, which is better than a tourniquet, as it touches only two points and does not prevent the blood circulating to the stump for its support; and this pressure should be continued till there has been sufficient time for the effusion of lymph.

In the second case the patient did not feel pain when the hot iron was applied to the artery, which was a remarkable circumstance. But although it should give pain, yet it ought not on that account to be disused. It is a case of life and death. The pain is supportable, and soon goes off.

It is remarkable in cases of hæmorrhage, that when something efficient is done, before there is time for any change to take place, the system becomes tranquil, there seems to be a sympathy between the arterial system and the diseased extremity of the vessel; and so long is the patient in a state of uneasiness as this something efficient remains undone. This is what Mr. Hunter called a "consciousness of wrong," the body being unable to be at rest, wanting to do a something which nature is incapable of accomplishing.

In the two cases above mentioned, I feel certain that the hæmorrhage ceased from the use of the actual cautery. I am not an advocate for using this remedy instead of ligatures; it is not so convenient nor so certain as ligatures, in recent cases. It is only when you can do nothing else that I recommend its use. It must be applied up the canal of the artery, or else the end only is shrivelled and no union produced. I find that the mere burning or searing the extremity of an artery is not to be depended on even in quadrupeds; the vessel will still bleed: I am certain, therefore, it would not do in the human subject. And I conceive that by the old method of applying the actual cautery, the bleeding was stopped by burning all the parts which constringed and pressed upon the vessels. I have ascertained that this method is sufficient in the dead subject to prevent injection being forced out; but, by simply cauterizing the arteries in the old way, without touching the surrounding parts, this cannot be effected.

The instruments required for this operation are a straight wire of corresponding size to the vessel to be cauterized, fitted with a canula, closed at its extremity to prevent the blood flowing into it and cooling the hot iron.

The artery having been slit up, as already mentioned, the canula is to be passed up into its sound part, having been first smeared with grease, which renders its introduction and removal easier, and also when heated burns the vessel with the hot grease, and assists in exciting the inflammation. The cautery iron having been heated, is then to be introduced into the canula at a *black heat*. The object is not to destroy the parts, nor to bring on sloughing, but only to produce a higher degree of inflammation, so that an effusion of lymph may soon take place and seal up the vessel; and for this purpose the black heat is sufficient. After the cauterization is effected, the canula may be withdrawn; but if it will not come away, it is not of consequence, and may be left, as in the first case, to come away of itself; for the process of closing the vessel goes on without inconvenience.

The following are some experiments which I made in reference to this subject:—

Exp. 1, which was performed with a view to the treatment of those aneurisms in which a ligature cannot be applied upon that part of the artery next the heart, shows that a wooden plug may be passed into a vessel, and the natural processes as regards its closure be accomplished. I divided the carotid artery of a dog, thrust a wooden plug an inch down that portion of the vessel next the heart, and tied it in. No hæmorrhage ensued, and the artery healed.

Exp. 2. On 6th Jan., 1818, two ligatures were put upon the carotid artery of a sheep, and the vessel divided between them. A hot iron was applied to the end next the heart, till about half-an-inch of it from the ligature towards that organ shrivelled and turned white. At noon of the following day the sheep was killed. A portion of the artery immediately below that which had been cauterized was one-sixteenth of an inch less than the corresponding vessel on the other side of the neck, and contained a coagulum an inch long; but in the uncauterized part the coagulum measured three-eighths of an inch. In other respects the two portions were similar.

Exp. 3. On the 12th Jan., 4 P.M., two ligatures were applied on the carotid of a sheep, which was divided between them. The ligature on that part of the vessel next the head was then untied, and the actual cautery passed up it; after which the ligature was retied to prevent hæmorrhage. *Twenty-one hours* after, the sheep was killed, and there was found in the cauterized end a very firm coagulum, two and a half inches long, completely filling the cylinder of the artery, to the extent of one inch from the ligature. The uncauterized end contained a slender filament of coagulum, one inch long.

Exp. 4. On the 19th Jan., 3 P.M., I cauterized the lower end of a sheep's carotid by passing in a tube closed at one end, and introducing the hot iron into it. The ends of the artery were tied as before. At noon of the following day the animal was killed; the ligatures were covered in with lymph, so that the cavity containing them and the ends of the artery was excluded from the air. The lower portion of the carotid contained a very firm coagulum, an inch and a quarter long, adhering strongly to the internal coat of the vessel. The coats of the artery and the surrounding cellular membrane were much inflamed, and a mass of matter having the appearance of coagulated blood, but which had probably been effused by the inflammation, surrounded the artery about half an inch from the ligature.

Exp. 5, made on Jan. 25th, was the reverse of the former. The lower portion of the vessel contained a clot of blood three-quarters of an inch long, and as thick as a probe. The upper portion had nearly the same appearance as the lower in the last experiment, except that the coagulum was about an inch longer, and that there was less coagulum around the outside of the artery. In both experiments the iron was passed only once, and as the red heat went off.

(2) Although in CLINE's experiment a wooden plug was introduced into the carotid artery of a dog, and the vessel, having been tied upon it, did well, it does not render any support to the plan proposed by CHELIUS for treating bleeding ossified arteries. In the former case the vessel was healthy, in the latter diseased, and not very likely to adhere. I should certainly prefer amputation with the hope of finding the artery healthy above; but if that were not done, I think it would be better to trust either simply to pressure, or to use the actual cautery for the purpose of shrivelling the vessel up, and inducing the formation of a clot, to form a natural plug, and rely upon the accompanying increased inflammation to do the best for the patient. Such cases, however, must always be considered very doubtful as to their successful termination.—J.F.S.]

303. Bleeding from wounded veins, although less thought of, may produce dangerous consequences. It is characterized by the above-described symptoms (*par.* 276); differences may, however, occur, which, for the moment, render the diagnosis difficult. If there be no prevention to the return of the blood, it flows in an unbroken current; but, if there be any obstacle, the blood spirts in a stream, or even in jets, as if from a wounded artery. This latter circumstance depends either on contraction of the muscles surrounding the vein, and is in direct proportion to the strength and frequency of the contractions; or it is consequent on the motion propagated from

the artery accompanying the vein, and, in this case, the manner in which the blood spirts out may easily deceive at the first moment, but compression above and below the wound will always determine the diagnosis.

304. Bleeding from the smaller veins usually stops of itself, if the patient be kept quiet, the edges of the wound brought together, and the circulation of the blood not disturbed. The clot which forms in the mouth of the wounded vessel prevents the escape of the blood, and, with the healing of the outer wound, that of the vein also takes place. But the bleeding is more severe, and requires the assistance of art, according to the condition of the wound, the size of the vein, and the existing obstacles to the return of the blood, such as the depending position of the wounded part, pressure upon the vein between the wound and the heart, exertion of the patient, by which either the muscles of the wounded part or those of the chest are contracted, and interruption to the return of the blood ensues; injuries of the large veins, as the internal jugular, the subclavian, the femoral, are soon fatal.

305. Compression is the usual remedy in venous bleeding; the ligature is seldom employed. The pressure must be made on the wounded part itself, and not to such extent as completely to flatten the walls of the vein, which would entirely check the return of blood, but only in a slight degree to support them. Especial attention must always be paid, at the same time, to the due freedom of respiration. The ligature must be applied, first on the lower, and then on the upper end, if the blood flow from the latter by regurgitation. It has the disadvantage of putting a complete stop to the return of the blood, and may also give rise to inflammation of the vein; it should, therefore, only be used when compression is not possible. Wounds which comprise the half or two-thirds of a vein, produce severe, and even fatal, bleeding, especially if the position of the part draw the wounded edges asunder. In this case, a better position and slight pressure often stop the bleeding; but frequently it will not cease till the vein has been completely divided. Venous bleeding, in extirpating tumours, or in amputations, usually stop when the patient ceases to scream, or by letting him frequently take a deep breath. If, however, bleeding from a large vein should continue, it is necessary to tie it; in such cases, for instance in amputations, in which I have frequently tied large veins, I have never observed any symptoms of phlebitis.

Compare Dupuytren (*a*).

[Venous bleeding in operations is sometimes very severe, especially in the removal of diseased breasts. Usually it is stopped by pressure on the divided veins, but sometimes this is insufficient, if the vessels be very large, and the cellular tissue have become brawny, so that the apertures will not come together, but remain open like holes in a sieve. A case of this kind happened to me some years ago, in which the venous bleeding was so sudden and severe, and the number of bleeding veins so great, that the woman, who was advanced in life, died under the operation. Some thought that air might have entered the veins and caused death; but I feel sure that the sudden loss of a large quantity of blood destroyed her. Should I ever meet with another case in which venous bleeding from the breast were so free, I am quite determined I would tie every vein, however tedious the operation might be rendered.

With regard to venous bleeding in amputation of the limbs, I never hesitate to tie the femoral vein, if it will not fall together and close; and I have never found inconvenience from it but in a single case. The extension of inflammation along the vein is, I think, from my own experience, scarcely to be expected. In the case of axillary aneurism mentioned at p. 307, my friend Green put two ligatures upon the external jugular vein, and divided it between them, to obtain more room to get at the artery, and no inflammation ensued.—J. F. S.

(*a*) As above.

Before dismissing the subject of bleeding from wounds, it will be neither uninteresting nor unprofitable to give a slight account

OF THE INTRODUCTION, OR RATHER RESUMPTION OF THE LIGATURE OF VESSELS,

As now employed, into the practice of Surgery. There is no doubt that the ligature was used by the ancient surgeons; but CELSUS appears to be the first who relied much upon it. To stop the flow of blood from a wound, he recommends that it should be filled with dry lint, over which a sponge dipped in cold water is to be applied, and pressure made with the hand. These applications are to be frequently renewed; and if the lint alone be unavailing, then vinegar is to be applied, as being very efficient in suppressing hæmorrhage, on which account some pour it into the wound. And he then proceeds, "quod si illa quoque profluvio vincuntur venæ, quæ sanguinem fundunt, apprehendendæ, circaque id, quod ictum est, *duobus locis deligandæ, intercidendæque sunt*, ut et in se ipsæ coëant, et nihilominus ora præclusa habeant." (*lib.* v. *c.* xxi.) And he also directs, in treating of castration, "in quibus cum multæ venæ discurrant, tenuiores quidem præcidi protinus possunt: majores vero ante *longiore lino deligandæ sunt;* ne periculose sanguinem fundat." (*lib.* vii. *c.* xix.)

After some time, but when is uncertain, the use of the ligature gave way to the practice of searing the wound with a hot iron, or of applying various caustic remedies, and no more is heard of it till THOMAS GALE, Maister in Chirurgerie, again brings it forward in describing the various kinds of stitches required in the treatment of wounds (*a*), as follows:—

"The fourth maner of stiching is when as a vayne or arterie is cut, and we use to stay the flux of blood, especially when as vene iugulares is cut. Then we thurst the needle through that vaine or arterye and then knit the same with the thried, then draw out the needle and let a portion of the threed hange out so longe untyll it falleth awaye." (p. 3.) Subsequently, also, in speaking specially "of woundes in vaynes and arteries," he says:—"If they be the smalle vaynes it shall suffyce to stiche the wound and use the pouder desiccatiue mencioned in the chapter goyng before, with twoe and the whighte of an egge. But if any of the great vaines be wounded, then the cure aforesaid is not sufficient. Wherefore you may attempt to stay the fluxe of blood with bending the contrary side to the place wounded; or with letting of blood in another place, whereby there is made diuersion of the fluxe. Also wyth frictions and rubbing the contrary parts. Yf these suffice not, then you must applye causticke pouders as *arsenicum sublimatum*, vitriall burnt, unsleked lime, or such like; or ells make cauterization with an yron, or *stiche the ende of the vaine.* And lay some desiccatiue pouder on it, and so dresse the wounde, lettyng it so remayne foure daies. And if there be any asker, (escar,) you must apply to it the whight of an egge and oile of roses well beaten together. And the cure that is heare spoken of vaines, is also to be understand of arteries; and the way to know whether a vaine or arterie is wounded: is by the yssuing oute of the blood. For in an arterie cut, the blood commeth leping and springing out with sume staye, accordinge to the dilatation and compressyon of the arterye." (p. 4.)

From the notes which MALGAIGNE has added to his recent edition of PARE's works, it appears that when PARÉ published his Surgery, in 1552, he still employed the actual cautery, and made no mention of tying vessels till the following edition in 1564, published at Paris, and bearing the title *Dix livres de Chirurgie avec Le Magasin des Instrumens necessaires à icelle*, in the seventh book of which, speaking of the treatment of gangrene and mortification which requires amputation, he first recommends tying the vessels to suppress bleeding after that operation in the following terms:—

"*Des moiens pour arrester le flux de sang quand le membre est coupé.*

Il est necessaire aller laisser fluer du sang apres l'amputation du membre.

"Lorsque l'amputation du membre est faitte: il est necessaire que quelque quantité du sang s'escoule, à fin qu'à la partie deschargee y suruiennent moins d'accidents, et ce selon la plenitude et force du malade. * * * Le sang escoulé en quantité suffisante (prenans tousiours indication des forces du malade) il faut promtement lier les grosses veines et arteres si ferme qu'elles ne fluent plus. Ce qui se fera en prenant lesditz vaisseaux auec vn tel instrument nommé bec de corbin. De cest instrument faut pinser lesdits vaisseaux. les tirant et amenant hors de la chair, dans laquelle se sont retirez et cachez soudain apres l'extirpation du membre, ainsi que font toutes autres parties tousiours vers leur origine. Ce faisant il ne te faut estre trop curieux de ne pinser seulement que lesdits vaisseaux: pourcequ'il n'y a danger de prendre auec eux quelque portion de la chair des muscles

Il n'y a danger de lier quelque portion de chair auec les dits vaisseaux.

(*a*) An Enchiridion of Chirurgerie, conteyning the exacte and perfect Cure of wounds, fractures, and dislocations; newly compiled and published. London, 1563.

ou autres parties. Car de ce ne peut aduenir aucun accident. Ains avec ce l'union des vaisseaux se fera mieux et plus seurement que s'il n'y auoit seulement que le corps des ditz vaisseaux compris en la ligature. Ainsi tires, on les doit bien lier auec bon fil qui soit en double." (ch. 13.)

In a subsequent chapter, (15th,) which he heads with: *Ce qu'il faut faire s'il suruenoit flux de sang à cause d'vn des susditz vaisseau deslié*, he describes another mode of proceeding, first advising, as more easy and less painful than the reapplication of a light bandage round the limb, as used in his time preparatory to amputation, "qu'vn ministre prene le membre à deux mains pressant fort de ses doigtz sur l'endroit du chemin desditz vaisseaux: Car en ce faisant il empeschera le flux de sang. Ce pendant tu prendras vne aiguelle longue de quatre pouces ou enuiron, quarree et bien tranchante, enfilee de bon fil en trois on quatre doubles, de laquelle tu relieras les vaisseaux en la façon qui s'ensuit: car alors le bec de corbin ne te pourroit seruir. Tu passeras laditte aiguille par le dehors de la playe, à demy doigt ou plus, à costé dudit vaisseau, iusques au trauers de la playe, pres l'orifice du vaisseau: puis la repasseras sous ledit vaisseau, le comprenant de ton fil et feras sortir ton aiguille en laditte partie exterieure de l'autre costé dudit vaisseau, laissant entre les deux chemins de laditte aiguille seulement l'espace d'vn doigt: puis tu lieras ton fil assez serré sur vne petite compresse de linge en deux on en trois doubles de la grosseur d'vn doigt, qui en gardera que le neud n'entre dedans le chair et l'arresteras seurement. Laditte ligature retire entierement dedans la bouche et l'orifice de la veine ou artere auec lesquelles aussi cachees et couuertes des parties charneuses adiacentes, se reprend aisement ledit orifice. Je te puis asseurer que iamais apres telle operation on ne voit sortir vne goutte de sang des vaisseaux ainsi liez. Et ne se faut trauailler d'user des susdits moyens d'arrester le sang aux petits vaisseaux: pource que aisement il sera supprimé par les astringents que nous te ordonnerons cy apres."

L'on ne se doit beaucoup sorcier du sang sortant des petits vaisseaux.

I have made these long extracts from Gale and Paré, as both were celebrated Surgeons of the same period, the former having been with Henry VIII.'s army at Montreuil in 1544, and with that of Philip of Spain, our Queen Mary's husband, at the siege of St. Quintin in 1557; and the latter surgeon to Charles IX. and Henry IV. of France. Gale in 1563 speaks of stitching the wounded vein or artery, and leaving one end of the thread to hang out until it falls away as a common practice with him; but does not advert to either of the methods proposed by Paré for tying the vessels after amputation, trusting to the potential cautery in preference to "actual cateriseng yrons, which sore feared the people with the orrror of cauterization, or burning as we call it, that many of them rather would dye wyth the member on, then to abyd the tirreble fyre, by means whereof manye people peryshed." (p. 56.) Paré uses the actual cautery in 1552, but in 1564 strongly recommends ligatures, but in a very different and preferable manner than as proposed by Gale. And among the reasons he assigns for such recommendation, he says:—"On ne vit oncques de six ainsi cruellement traittez, eschapper deux, encore estoient ils long temps malades, et mal-aisement estoient les playes ainsi brusleees, menees à consolidation, pource que vne telle vstion faisoit des douleurs si vehementes que les malades tomboient en fieure, en spasme et autres mortelles accidents auec ce que le plus souuent l'escare cheut suruenoit nouueau flux de sang qu'il falloit encor estancher auec les cauteres actuels et potentiels, lesquels repetez consumoient vne grande quantité de chairs et autres parties nerueuses. Pour laquelle deperdition les os demeuroient puis apres nuds et decouuers. Ce qui a rendu à plusieurs la cicatrisation impossible, aiants tout le reste de leur vie gardé vn ulcere au lieu du membre couppé, qui leur ostoit le moyen de se pouuoir seruir d'vn membre fait artificiellement." (chap. xvii. p. 115.) From a comparison of these accounts it must be admitted that, although to Pare must be assigned the just praise of having reintroduced the employment of the ligature as now used, (for it is of little consequence whether he was aware of Celsus having recommended it or not, he has made it so completely his own,) yet Gale's practice of tying vessels, though in a different manner, was earlier given to the world than Paré's, and his horror of the actual cautery not less great, although less picturesquely described.

The ligature of arteries, as recommended by Paré, was very slowly received by Surgeons, and even so late as 1761 it appears in the fourth edition of Sharp's *Critical Enquiry into the present state of Surgery*, that the forceps were not used, but Paré's second method with the needle employed, and in many parts of Europe not even that, whilst in France some of the Surgeons at least thought it not applicable in all cases, and sometimes used it, and at other only lotions of vitriol or of alum.

The tenaculum, now in common use by some practitioners in preference to the forceps, was invented by Bromfield, Surgeon of Guy's Hospital.—J. F. S.]

306. The *removal of foreign bodies* from the wound, is, next to stanching the blood, the circumstance which requires the greatest attention; because, if they remain, the healing of the wound is disturbed, and severe inflammation, suppuration, gangrene, nervous symptoms, and the like, may be produced. Foreign bodies may be either sand, pieces of clothing, bullets, broken pieces of the wounding instrument, fragments of bone, and the like. The presence and position of such bodies are to be ascertained by examination of the wound, which, in incised wounds, is attended with no difficulty; but, in stabs and gun-shot wounds, the difficulty is often very great. They are to be drawn out either with dressing-forceps or with bullet-forceps, of which those invented by PERCY are the most convenient, inasmuch as they serve at once for spoon, forceps, and ball-screw. If a foreign body lie near the skin, on the side opposite to where it entered, it must be removed by an incision at that place. If the form of the wound prevent the drawing out of the foreign body, it must be dilated in the proper direction. If a foreign body, a bullet, for instance, have penetrated into a bone, its removal is generally difficult. If superficial, it may often be removed with a spatula or an elevator. If it lie deeper, or be wedged in between two bones, the bullet-screw must be used. If it cannot be reached by these means, it must be left alone, in the hope it may become loosened during suppuration; at least, this seems better than to remove the foreign body with mallet and chisel, or with the trepan; an exception, however, is to be made if the body be lodged in the skull. When a bone is splintered, care must be taken to remove only those pieces which are entirely loose; such as are still attached should be pressed into their place, in hope that they may unite or be discharged during suppuration.

The greatest care must be taken in the removal of foreign bodies. It is only very rarely that they remain without inconvenience, by becoming enveloped in a cellular capsule. Often, at a subsequent period, they sink deeper in various directions, produce pressure, inflammation, suppuration, and so on. Only when the removal of the foreign body would cause greater mischief than letting it remain, or when the wound is already much swollen, or the extraction of the foreign body is impossible without great violence, or when it closes large blood-vessels, is its removal contra-indicated.

307. When the bleeding is stanched, the foreign bodies removed, and the wound cleaned, its condition must decide whether the further treatment is to be effected by *quick union*, or by *suppuration* and *granulation*. The former kind of treatment is always preferable, because the healing is quickest, is least interfered with by untoward accidents, and leaves the least trace of the injury behind it.

308. The cleaner the solution of continuity is, the more is it disposed to quick union. When the divided parts have suffered much stretching, tearing, and bruising, before giving way, the inflammation which follows is not such as will bring about the healing of the wound by quick union; but suppuration necessarily ensues. Various, however, are the degrees, from simple division of a part by a cut, to wounds with destruction of parts by bruising. Slight bruises require union, and severe bruises do not contra-indicate it: and, even although the condition of the part give but little hope that it will be effected, yet much is gained if the edges of the wound hold together only at some few points, because its extent is thereby diminished, and the suppuration much lessened. Only in wounds where the greatest degree of bruising and tearing has occurred, can no union or approximation of the edges of the wound be undertaken.

Simultaneous injury of bone does not contra-indicate union. Union may even take place of completely separated pieces of bone hanging in the flaps of the soft parts. The proper adjustment of the bony fragment is, however, very difficult in these cases, especially if the flaps of the wound be swollen. Hence the advice given by many, that the pieces of bone should be cut out from the flaps, and the latter properly arranged.

The form and extent of the wound give no definite contra-indication to its union. If the bleeding be slight, an accurate approximation of the edges of the wound will stanch it; but, if the bleeding be considerable, it must first be stanched, and upon the mode in which this is effected depends whether union will take place.

The presence of foreign bodies in the wound, which merely act mechanically, contra-indicates union only so long as they remain there. The existence of deleterious matter in the wound contra-indicates it altogether.

When the secretion of a fluid takes place from the bottom of a wound, the retention of which would excite dangerous symptoms, union is contra-indicated, unless such retention may be made use of as a means towards effecting a cure.

309. A wound to be united must be properly cleansed, the blood-clot removed from it, and then such apposition of the wounded edges made as shall bring similar structures into contact. The means to be employed for this purpose are, *the proper position of parts*, *uniting bandages*, *sticking plaster*, and *sutures*. In most cases, union is effected by several of these methods.

[" It is with a view to this principle of union (by the first intention)" says JOHN HUNTER, " that it has been recommended to bring the sides (or lips) of wounds together; but as the natural elasticity of the parts makes them recede, it has been found necessary to employ art for that purpose. This necessity first suggested the practice of sewing wounds, and afterwards gave rise to various inventions in order to answer this end, such as bandages, sticking plasters, and ligatures. Among these, the bandage, commonly called the uniting bandage, is preferable to all the rest where it can be employed; but its application is very confined, from being only adapted to parts where roller can be used." (p. 209.)]

310. The *position* of the wounded parts should always be such that the edges of the wound may be relaxed, and their retraction diminished. This is specially to be observed in transverse wounds of muscular parts. Such wounds on the *extensile side* of a limb require the *straight*, and, on the *flexile side*, the *bent* position. Longitudinal wounds usually need no particular position, because in them retraction of the edges cannot be very great; in general, therefore, that position is chosen in which the parts are stretched. The position of the wounded part is only the preparation and aid to union.

311. *Uniting Bandages*, (*Fasciæ unientes*, Lat.; *Vereinigende Binden*, Germ.; *Moyens unissans*, Fr.,) so called in opposition to those which merely serve to keep dressings together, are such as produce and maintain the immediate apposition of the edges of wounds. Their application is very different according to the form, direction, and locality of the wound. In transverse wounds of the extremities, two long strips of linen, of corresponding breadth with the wound, are required. One of these is to be divided to its middle into as many heads as its breadth contains inches; the other piece is to have a corresponding number of slits made in its middle. These two pieces are to be placed on the limb above and below the wound, and fastened with the spiral bandage. The heads of one strip are next to be passed through the corresponding number of slits in the other, drawn in

opposite directions, and the two ends then fastened with the continuous turns of the circular bandage. In longitudinal wounds of the extremities a circular bandage is employed, which is divided at one end into heads, an inch broad, and, at a proper distance, according to the thickness of the limb, is furnished with slits. The middle of the bandage is to be placed on the side of the limb opposite to the wound, both ends are to be brought towards the wound, the heads drawn through the slits, and properly carried on in circular turns, and in opposite directions.

If the bandage be to act, specially, on the bottom of the wound, a graduated compress must be applied on both sides, and the bandages drawn together upon them. The influence of the uniting bandages is never to be too much relied on, as the linen always, more or less, yields, and gets displaced. Therefore bandages, when the union of the wound is effected by other means, are applied only to assist the union, prevent the retraction of the parts, and so on. An expulsive bandage, in many cases, answers the same object; for instance, in amputations.

[As to the use of bandages in wounds, I must confess I am no advocate for them unless they are *absolutely* necessary to prevent the parts dragging asunder, and then only the least possible quantity should be employed. A simple spiral bandage carried once over the wound, and extending a little above and far below it, if from the pressure on the superficial veins there be tendency to serous effusion in the cellular tissue, or a many-tailed bandage is amply sufficient. A quantity of bandage of many thicknesses as used even within my recollection is very detrimental, as heating the part and tending to promote suppuration, which it is desirable to avoid.—J. F. S.]

312. *Sticking Plaster*, (*Heftplaster*, Germ.; *Agglutinatifs*, Fr.,) which is most especially employed as a means of closing wounds, operates more certainly than the bandage. When the surface of the wound has been properly dried, and the parts brought into suitable position; the one end of the sticking plaster is to be applied at sufficient distance from, and on one side of the wound, to be held fast there, and when the edges of the wound are brought into the closest contact, the other end is to be drawn across them, and pressed down on the other side. The first piece of plaster is to be laid upon the middle of the wound, and then as many on both sides as will bring the edges in perfect union, and cover the wound itself uniformly. In longitudinal wounds of the limbs, the middle of the plaster may be laid directly opposite to the wound, and the two ends may be brought towards the wound, the one passing through a cleft in the other, crossing upon, and thus uniting, the wound. If the sticking plaster is to be applied on a part covered with hair, the part should be first shaved. In making the sticking plaster, the *emp. adhæsiv.* should be spread not too thick, but sufficiently so, upon strong linen. In small superficial wounds English sticking plaster (court-plaster) answers the purpose.

[The old surgeons, though mostly relying on bandages and sutures, employed a sort of sticking plaster, though differing from the kind now used; thus THOMAS GALE, when describing "briefely the cure of a simple and small wounde, where the skynne onely is divided or cut," says:—"You shall aptly ioyne the lippes or sides of the wounde together, so euen as possible you can: then make a stufe wythe towe and the whyte of an egge mixed with a little salte, and apply it to the wounde, then roll and bynde it accordyng to arte, and this is sufficient in such kynde of woundes. You must also commaunde the Pacient that he exercise not the wounded member, least that he causeth accidentes to falle to the wounde, as inflamation, fluxe of humours, dolour, and payne, &c. * * * If the wounde be great in the fleshe, and yet without accidents, you shall beginne your cure as in the chapter before, (the previous paragraph,) that is, by comprisyng and ioyning the sydes of the wounde together, and then rollynge and byndyng it. But if the wounde be bigge, wyde, or els ouerthwarte the member, so that rollinge and binding are not sufficient: than you are compelled to use stiching, of which there be diuers sortes, and I wyll set oute those whiche are moste in use. But or you goe aboute the stitching of the wounde, geue diligent heede that it be mundified and made cleane, that there remayne not in it eyther any uncleannesse, as heare, duste, oyle, or such lyke: whiche may hynder the adglutination of the wounde." (p. 2.)

"A piece of sticking plaster," says John Hunter, "which has been called the dry suture, is more general in its application than the uniting bandage, and is therefore preferable to it on many occasions. I can hardly suppose a wound, in any situation, where it may not be applied, excepting penetrating wounds, where we wish the inner portion of the wound to be closed equally with the outer, as in the case of hare-lip. But even in such wounds, if the parts are thick and the wound not large, the sides will seldom recede so far as to make any other means necessary. The dry suture has an advantage over stitches, by bringing a larger surface of the wound together, by not inflaming the parts to which it is applied, and by neither producing in them suppuration or ulceration, which stitches always do. When parts, therefore, can be brought together, and especially where some force is required for that purpose, from the skin not being in large quantity, the sticking plaster is certainly the best application * * * The sticking plasters should be laid on in strips, and these should be at small distances from each other, viz., about a quarter of an inch at most, if the part requires close confinement; but when it does not, they may be at great distances. This precaution becomes more necessary if the bleeding is not quite stopped; there should be passages left for the exit of blood, as its accumulation might prevent the union, although this does not always happen. If any extraneous body, such as a ligature, should have been left in the wound, suppuration will take place, and the matter should be allowed to vent at some of those openings or spaces between the slips of plaster. I have known a very considerable abscess formed in consequence of this precaution being neglected, by which the whole of the recently united parts has been separated." (pp. 209, 10.)

Our common hospital sticking plaster is the soap plaster of the London Pharmacopœia, with a little resin to render it more adherent, spread on stout calico. I prefer it, however, without the resin, as less likely to cause irritation, and the plaster is quite sticky enough if fresh spread. Tyrrell was accustomed to use equal parts of soap plaster and compound frankincense plaster but I do not know that it possesses any superiority over the soap plaster, except in having a more agreeable smell. Liston (*a*) prefers a transparent plaster, consisting of a solution of isinglass, spread on the unglazed side of silk, which, when used, requires a hot moist sponge to be run quickly over it, so as to melt the isinglass and render it sticky. "This composition," he says "becomes sufficiently adherent; it keeps its hold often to the end of the cure; and it is quite unirritating. Being transparent, the plaster does not prevent any untoward process that may be going on underneath from being observed, and, if any fluid collects, an opening can be snipped for its escape." (p. 33.) I have used this isinglass plaster several times, but do not find it has any material preference over the common adhesive. It is not a new invention, but has been long since used in Germany, where it is called English plaster, and is really no other than our common court-plaster spread on white silk.—J. F. S.]

313. *Stitching*, or *Suture*, (*Sutura*, Lat.; *Naht*, Germ.; *Suture*, Fr.,) which was anciently so much in use, and at a later period has been entirely discarded by many Surgeons, is always accompanied with a considerable irritation of the wound. Inflammation, and retraction are often excited to such degree by the presence of the threads, that the adhesive process cannot be perfected, and suppuration takes place. However much these reasons may limit the use of the suture, yet in the following instances it is necessary:—1. In widely-gaping wounds of the face, in which it is desirable to produce very close union, especially if the salivary duct be injured, or the lips perfectly divided. 2. In transverse cuts in such parts as have great disposition to retract. 3. In deep transverse wounds of the tongue. 4. In wounds with large flaps. 5. In large penetrating wounds of the belly. 6. In wounds of parts whose peculiar structure admits no other union, as clefts of the ears and eye-lids. 7. In complete tearing through of the perinæum during difficult labour.

[John Hunter was certainly no advocate for the use of sutures, for he observes:—"The interrupted suture, which has generally been recommended in large wounds, is

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(*a*) Practical Surgery.

still in use, but seldom proves equal to the intention. This we may reckon to be the only one that deserves the name of suture; it was formerly used, but is now in a great measure laid aside in practice, not from the impropriety of uniting parts by this process, but from the ineffectual mode of attempting it." (p. 210.)

The use of sutures to retain the edges of a wound together, and thereby encourage the process of adhesion, is still a matter of dispute among Surgeons; some employing them on every occasion, and others never using them at all; some considering that they are very powerful auxiliaries in uniting a wound, and others that they are objectionable as oftentimes exciting constitutional irritation, and thereby disturbing or preventing the adhesive process. The real, though generally overlooked, ground of objection to them is their indiscriminate use, both as to the condition of the parts on which they are applied, and the length of time they are left after having been introduced.

Sutures are commonly employed "in those parts of the body," to use HUNTER's expression, "where the skin recedes more than in others;" and here he considers "this treatment becomes most necessary." (p. 210.) But to this it may be added, that they are very frequently employed to drag together the skin edges of a wound which, without them, could not be brought together at all. Or they are used without any reason whatever, as in scalp-wounds; of which HUNTER remarks, that "as the scalp probably recedes as little as any part of the body, it is therefore seldom necessary to apply any thing in wounds of that part." (p. 210.) Or they are left in so long, even when their introduction has been proper, that they become irritants, and undo the good they might have served to. I cannot agree even with HUNTER upon the necessity of employing sutures, when parts recede from each other; nor with the practice of dragging them together with sutures when otherwise they cannot be retained in connexion, for this simple reason, that if they pull at all upon the parts they are purposed to unite, ulceration is immediately set up at the points where they press, and speedily they cut their way through and are entirely useless. In wounds of the scalp, or of other parts, which with a little management and by position may be kept together, they are unneeded, and, in the scalp especially, they often act as extraneous bodies and excite, or at any rate keep up, irritation, as is proved by the irritation subsiding when they are removed. They are also objectionable, under any circumstances, if left in after they have induced ulceration, which is a proof that the constitution is desirous of ridding itself of them; under this condition, independent of the irritation which they may, and often do produce, their occupation is gone; they become loose, and therefore no longer hold the parts together.

If judiciously employed, however, and not permitted to remain too long, sutures are often very useful. But their sole object is to keep parts which readily fall together or can be brought into contact, more steadily in their place, and to prevent them slipping one way or other out of their proper position, neither of which can be so well effected either by bandage or sticking plaster. Upon these principles alone should sutures be used, and not with the intention of forcibly bringing together parts which, from various causes, may be indisposed or incapable of themselves to come into contact. Thus it is very proper to connect by suture the edges of a wound of the eyelid, of the mouth, or even of the nose, either of which readily fall together; but unless retained in their place unite awry, and cause much disfigurement. But it is very improper, as well as very useless, to employ sutures in a wound across a muscle, which may or may not be involved in the wound; because the action of the muscular fibres will be constantly pulling the edges of the wound asunder, and thus dragging on the sutures, compel them to become irritants and excite ulceration, until they cut through and free the skin which they vainly attempt to confine.

As regards the time they should be allowed to remain, and during which they are of any real use, under the most favourable circumstances for their employment, as a general rule, from thirty to fifty hours is the utmost space of time for which they should be left. They should, if possible, always be removed either before or immediately after they have began to ulcerate, which is known by the needle-hole assuming a little redness and becoming moist by the welling up of a very minute quantity of pus, often, indeed, only sufficient to damp and thicken the thread. Directly this occurs, however soon it is observed, the suture should be cut on one side of its tie and removed, because from that time the suture has effected all it can do and begins to act as an irritant.

The number of sutures to be used depends on the nicety requisite to adjust the position of the divided parts; and they should never be thick, as the larger they are the more distinct will be the little hollow scars which they always leave. They should never be drawn so tightly as to pucker the edges of the skin which they include, but merely so tight as to bring the edges all but close; consequently the loop should be, when first made, rather loose, as it soon becomes sufficiently tight by the outpouring of adhesive matter between the edges of the wound and into the neighbouring cellular tissue.

As a general rule I think it best, when sutures are put in, to make use of so many as without further assistance will keep the parts well in place, and then overlay the whole wound with a piece of soft linen dipped in cold water, which should be continually changed as it begins to dry; neither lint nor anything else which has upon it any fluff should be used for this purpose, as it entangles with the effused adhesive matter and at every removal disturbs the wound. The object of the cold application is to regulate the vascular action of the necessary inflammation. I rather prefer many sutures to the employment of few, which require the conjoint application of sticking plaster.

Sutures should only be employed when the wound is clean cut, never when it is much torn or bruised; as under the latter conditions union by adhesion cannot reasonably be expected to take place. A clean cut wound, made either accidentally, or purposely in operation, even though of several inches in length, will frequently be united throughout, if its edges be properly adjusted, in twenty or thirty hours. This observation especially applies to wounds of the face.

Wherever they can be used, and there is scarcely a case in which they cannot be employed, I prefer DIEFFENBACH's practice of using thin insect pins and the twisted suture; but all that has been stated in reference to the suture with thread, equally applies to that made with pins.—J. F. S.]

314. The sutures in use are, the *Interrupted Suture*, (*Sutura nodosa, interscissa*, Lat.; *Knopfnaht*, Germ.; *Suture entrecoupée*, Fr.,) the *Twisted Suture*, (*Sutura convoluta*, Lat.; *Umwundene Naht*, Germ.; *Suture entortillée*, Fr.,) the *Quill Suture*, (*Suture clavula*, Lat.; *Zapfennaht*, Germ.; *Suture enchevillée*, Fr.,) and the *Glover's Suture* (*Gastroraphe*, Lat.; *Darmnaht*, Germ.; *Suture des pelliers*, Fr.) The interrupted and quill stitch will be here alone considered as those used in common wounds; the others will be, by-and-by, more particularly noticed.

315. For the application of the *interrupted suture*, a needle of good steel is to be used, curved, so as to form the segment of a circle, very pointed, and cutting on either side for a third of its length; the other end should be thinner, rounded off, and furnished with an eye; it is to be so held, in the right hand, that the thumb rests on the concave, and the fore and middle fingers on the convex side. At a distance from the edge of the wound, of from three to eight lines, (according to the gaping of the wound,) the needle is to be introduced, and, when the point has reached the bottom, a movement must be made, so that the opposite edge of the wound may be transfixed; to facilitate the passage of the needle the skin must be pressed against its point, with the thumb and fore finger of the left hand. When the needle has been drawn through, the waxed thread contained in its eye must be drawn after it, the edges of the wound brought into contact, and the ends of the thread tied so that the knot may be placed on one or other edge of the wound, and it is, also, to be particularly observed that the ends of the threads be not drawn together tighter than is necessary to bring the edges of the wound in close connexion. If the wound be very deep and gaping, the thread may be provided with two needles, and the edges of the wound pierced from within outwards. It depends on the size and direction of the wound how many stitches should be used; commonly a stitch to an inch is computed, but frequently one stitch is sufficient for a large wound, because the union of the rest of the wound is possible by means of sticking plaster. The first stitch should be in the middle of the wound, or at that spot where the edges of the wound, by reason of its form, most closely correspond (1).

Upon the different form of needles for wounds, see KROMBHOLZ's Akologie, vol. i. p. 375.

The application of a suture with a single thread, with which loops are formed, which are then cut through, is improper on account of the irritation of the wound of the needle by the drawing through of a long thread.

[(1.) So our old friend Maister GALE, who also gives the reason for his recommendation:—"Make your first stiche in the middes of the wounde, than a finger breadeth from that make another on bothe sides of the midle stich, so leauing the space of a fynger breadeth, make so manye stiches as the wounde requireth. And take this for a generall rule that you neuer begynne your stiching at the ende of the wounde, because through that occation the wounde might be drawen awrye, and the member lose his beautie, and some tyme parte of his office. And beginning your stiches in the middes, this foloweth of necessitie that your stiches shal be odde, if there be more or lesse than twaine. And if the wounde be deepe and ouerthwarte the member, then you must make your stiches deeper, and that for two causes, the one for that it shoulde not breake out againe, the other that the wounde myghte haue lesse matter and better take consolidation. (pp. 2, 3.)]

316. The *quill suture*, especially employed for the union of wounds of the walls of the belly, but which is now almost out of use, is distinguished from the interrupted-stitch, inasmuch as the ligature consists of two threads separated on either side of the wound; between which threads small cylinders of wood corresponding with the length of the wound are interposed, upon which the threads are tied, so that the edges of the wound are compressed together throughout their whole length.

317. When the suture is applied, the union is to be assisted by sticking plaster, which is to be placed between the stitches; the wound is to be covered with fine charpie, with a compress, and the whole supported with some turns of a circular bandage.

318. The patient is to be kept at rest after the closing of the wound, and an antiphlogistic regimen pursued. If there be much traumatic reaction, active antiphlogistic remedies must be used. If severe pain and swelling of the edges of the wound occur, the bandage must be loosened, lead wash applied, and if, after the application of the sutures, the threads seem likely to tear through they must be removed, and the edges of the wound kept together with sticking plaster. If the loosening of the dressing, from these circumstances, or from after-bleeding, be not necessary, it may be left as long as it is not rendered too foul by the secretion from the wound. This at the first soaks into the dressings, subsequently dries, and the first dressing may, even in severe wounds, as in amputations, be often left until the cure is completed (in the strictest sense, *per primam intentionem.*) If the bandage be rendered too moist by the secretion from the wound, or if it have a bad smell, especially in hot weather, the superficial dressings must then be removed, but the sticking plaster left, if it keep the wound well closed. When, however, it is to be renewed, both ends of one piece of the sticking plaster must be loosened first towards the wound, and the middle part last, the edges of the wound being at the same time gently supported. As one piece of the plaster is removed, and the wound cleansed, another piece should be applied, because, if the wound be at once stripped of all the sticking plaster, the already united edges easily separate from each other. In this way the bandage is to be renewed daily, every other day less frequently, according to the quantity of secretion from the wound; in doing which it is also to be specially observed, that the connecting bandages are to be loosened with warm water previous to their removal, and the ligature threads not dragged. If stitches be used, the threads may be removed between the second and fifth days, the knot being cut, and the thread drawn through with forceps on the other side.

319. If quick union do not take place, or if, on account of its condition, (*par.* 308,) a wound cannot be brought together, it must heal by *suppu-*

ration and *granulation*. Such wound, after being cleaned from blood, should be covered with a quantity of fine charpie, spread with mild salve, and confined with sticking plaster or a bandage. On the third or fourth day the bandage should be removed, having been first loosened with warm water, and replaced by dry charpie if suppuration have commenced. The charpie often becomes firmly connected with the bottom of the wound, and so remains, even when suppuration is going on. This is especially the case in those wounds which are of some depth; for instance, after the extirpation of swellings, and so on. The bottom of the wound is, in these cases, to be overspread with a light linen compress, or German tinder, and charpie over it (1). When granulations rise up in the wound, its healing is promoted by moderate compression of its edges with sticking plaster. If the suppuration be moderate, the wound may be dressed once in every twenty-four hours, but, if copious, twice in the same time. A moderate degree of inflammation must always accompany the secretion of good pus; if this be insufficient, if the wound be pale, the edges flabby and bleeding on the slightest touch, stimulants, as *ung. digest. basilic.*, a decoction of bark or willow bark, and the like, must be applied to excite the proper degree of inflammation. The treatment proper for abscesses, warm applications, is, however, generally preferable. In too active inflammation, when the bottom of the wound is dry, and its circumference swollen, all stimulants must be removed, and the wound covered with mild salves and softening poultices. If the granulations be luxuriant, they must be touched with caustic, and a slightly compressing bandage applied, which very much furthers the healing. Should the secretion and absorption of the pus produce symptoms of hectic fever, the powers of the patient must be supported with strengthening remedies; bark, calamus, wine, good food, and pure air are best.

[(1) This method of stuffing a wound which must heal by suppuration is quite inadmissible, for it only adds fuel to fire by the adherence of the charpie or lint, even though spread with mild salve, acting as an extraneous body. So soon as bleeding has ceased, or has been stopped, a poultice should be applied, and nothing else, as it regulates the temperature, encourages suppuration, and renders the parts soft and easy, instead of unyielding and painful.—J. F. S.]

I.—OF INCISED WOUNDS.

(*Vulnera scissa*, Lat.; *Schnitt und Hiebwunden*, Germ.; *Plaies par instrumens tranchans*, Fr.)

320. Both soft and hard parts may be divided by cutting and chopping. These wounds are most disposed to quick union, and what has been already mentioned upon the union of wounds in general applies also to them. The following circumstances, however, require particular notice.

321. Longitudinal wounds of tendons are not, generally, attended with peculiar symptoms, unless the synovial membrane, which ensheaths many of them, be inflamed. Transverse wounds of tendons may be either partial or complete. In complete division, both ends retract, one by the action of the muscle; the other by the motions of the limb, produced by the superior power of the antagonist muscles. If the ends of the tendon can be brought into close contact, they unite; but, if not, they are joined by some cellular intersubstance which gradually becomes firm; or they unite with the neighbouring parts, in consequence of which motion is prevented. The mutual contact of the ends of a tendon is effected chiefly

by the position of the part to which the tendon is attached; for instance, in wound of an extensor tendon, the part must be put straight, in wound of a flexor it must be bent. If several tendons be divided at the same time, two opposite ends of tendons may usually be brought together till it is not easy to determine whether they belong to each other. Stitching tendons together is out of use; but, recently, it has been again employed with advantage (*a*).

In division of the extensor tendons of the hand and fingers, the board proposed by Evers (*b*) is used, on which the fore arm is fastened by means of a bandage, so that the hand and fore arm are kept at a nearly right angle. In rupture of portions of the *m. extens. carpi rad.* and *uln.*, which happened by falling on the back of the hand without any accompanying wound of the skin, I have produced a perfect cure by the use of this apparatus.

322. If a large nervous trunk have been cut through, paralysis of the part, to which it goes, usually takes place, because both its ends retract considerably, and can be united only with great difficulty, or not at all. If, however, the ends of the divided nerves unite accurately, their conducting function is only momentarily suspended, and afterwards becomes restored.

The dispute about the regeneration of the nerves and the recovery of their function after division has continued ever since the time of Cruikshank. The following circumstances, however, favour the opinion just given. Divided nerves retract from two to four or six lines, on account of their tension and the contractility of their sheath and of the cellular tissue connecting their bundles. Generally some nervous pulp escapes from the divided bundle of fibrils, redness and swelling extend from half an inch to an inch along the nerve, further, however, on the upper than on the lower end. Coagulable lymph is poured out, and vessels are formed. By the outpouring of lymph into the cellular sheaths and into the cellular tissue connecting their fibres, a swelling is produced larger at the upper than at the lower end. The divided nerve is united in a few days by lymph; the connecting mass becomes denser and the vessels appear less full of blood; the swollen ends approach nearer, run together, and thus the connexion is reproduced. Their connecting power is restored more quickly in proportion as the space between their ends was less. That the reproduction of their functions is not dependent on the anastomosis of nerves is proved by the fact, that if the newly united nerve be again divided, its functions are again interrupted. It appears from Haighton's experiments that if the pneumo-gastric nerves be divided on both sides at once, death will speedily ensue, but this is not the case if they be divided at long intervals. Meyer has observed the same effect in the application of nitric acid to the scar of nerves as to the nervous mass itself. Larrey even found that after amputation the ends of the several nerves of the stump united like loops, so that on making a section at the place of union no trace of a cicatrix could be found.

Fontana, Traité sur le Vénin de la Vipère, Florence, 1791, vol. ii. p. 177.

Arnemann, über die Regeneration der Nerven. Götting., 1787.

Haighton, J.; in Philosophical Transactions. 1795.

Meyer, in Reil's Archiv., vol. ii. part ii. p. 449.

Meckel, Handbuch der Menschl. Anatomie, vol. i. p. 345.

Larrey, Notice sur quelques Phénomènes Pathologiques observées dans la Lésion des Nerfs et dans leur Cicatrization; in Révue Médicale, 1824, Marseil., p. 406.

Pauli, above cited, p. 71.

Note sur la Régenération du Tissu Nerveux; in the Mémoires de la Société de Physique et d'Histoire Naturelle de Genève, vol. iii. part ii. 61.

Prevost; in London Medic. Repos., Jan. 1828, p. 79.

Tiedemann, über die Regeneration der Nerven; in Zeitschrift für Physiologie, vol. iv. part i. p. 68.

Hamilton; in Dublin Journal, March 1838.

(*a*) Valentin and Robert; in Journal des Connaissances Med.-Chir., March, 1839, No. ix. p. 107

(*b*) Neue vollstandige Bemerkungen und Erfahr- zur Berichtigung der Wundarzneikunst. Götting., 1787, § Stark Verbandelehre, plate xix. fig. 188, 189.

323. Flap wounds must always be brought together very closely, and the flaps kept, by due pressure, in connexion with the surface of the wound. Several stitches are commonly employed, the union maintained with sticking plaster, the entire flap covered with charpie and compresses, and the whole properly kept together with a bandage. If suppuration take place, its collection and burrowing must be prevented by a suitable compressing bandage, by counter-openings, and so on.

324. If a part have been completely separated from the body, the replacement of such separated piece is always indicated, as the possibility of its healing is fully confirmed by experience. But the union of such a piece must be very close, the vital activity and the natural warmth must not have been completely lost. It is best fixed with several stitches, and its close application must be assisted with a bandage. It is of the greatest importance that the bleeding should be perfectly stanched before its adaptation, and, if possible, without pressure. Warm applications of wine, or of cotton dipped in aromatics, are serviceable in exciting the vital activity. Bluish, blackish discoloration, loss of the cuticle, and partial gangrene of the reapplied part, should not induce us to loosen the stitches, as, notwithstanding these symptoms, union may take place. If there be loss of substance in the wound of a part where the skin is very movable, it may often be covered by drawing together the skin from both sides of the wound. If a piece of this kind do not heal on, the wound must be treated according to the rules already laid down (*par.* 319.)

Of the many cases known of the reunion of perfectly separated parts, which have been mostly collected by **Wiesmann**, and increased with observations of his own in his work, De Coalitu Partium à reliquo Corpore prorsus Disjunctarum, Lipsiæ, 1824, I would specially refer to the following:—

Fioravanti, Il Tresore della Vita Umana. Vinez., 1570.

Garengeot, Traité des Opérations de Chirurgie. 2 vols. Paris, 1720. 8vo.

Carpue, J. C., An Account of Two successful Operations for restoring a Lost Nose from the Integuments of the Forehead; with Remarks on the Nasal Operation. London, 1816. 4to.

Busch in **Rust**'s Magazin, vol. vi. p. 2.

Bunger in **Graëfe** and **Walther**'s Journal, vol. vi. part iv.

von **Walther**, Ibid., vol. ii. part iv., vol. vii. part iv.

Markiewitz, Ibid., vol. vii. part iv.

Dieffenbach, Ibid., vol. vi. parts i. iii.

Hoffacker, in Heidelberger klinischen Annalen, vol. iv. p. 149.

Richerand, Nosographie Chirurgicale, vol. i.

Diefenbach, Chirurg. Erfahrungen über die Wiederherstellung Zerstörter Theile u. s. w., vol. i. part ii. p. 153.

II.—OF PUNCTURED WOUNDS.

(*Vulnera puncta*, Lat.; *Stichwunden*, Germ.; *Plaies par instrumens piquans*, Fr.)

325. Punctured wounds are those produced with a narrow, pointed instrument, and in which such parts only are divided as are opposed to its point. The division by a puncture may be as clean and simple as that from a cut, if the instrument be flat, cutting on both edges, and not thick. In most cases, however, more or less dragging and tearing are produced by the penetration of the thick part of the instrument; thrust wounds are,

therefore, generally more dangerous than cut wounds; it is more difficult to examine them, they produce more active inflammation, higher fever, nervous symptoms, suppuration; important parts are commonly wounded by the deep penetration of the instrument. Simple stabs, for instance, with a flat sharp-pointed blade, heal just as readily by quick union as cuts do; but, if the parts have suffered from tearing and bruising, the track of the stab suppurates.

326. The *treatment* of stabs must, in general, be quite simple. After the blood has been gently pressed out, and the wound cleansed, the opening is to be covered with sticking plaster, the parts brought into a proper position, and a graduated compress laid upon the track of the stab, which is to be *moderately* fastened with a bandage; the patient is to be treated strictly on the antiphlogistic plan, and cold applications used to allay the inflammation. Under this treatment the wound often heals by quick union, without any particular occurrence. If active inflammation and swelling take place, we must employ, with the proper general antiphlogistic treatment and after general blood-letting, leeches in the neighbourhood of the wound, and softening poultices. When suppuration takes place, the discharge of the pus must be promoted by the proper position of the part, by suitable pressure from the bottom of the track of the wound to its orifice. If the matter collect and burrow, the position of the part must be changed according to circumstances, the opening of the wound enlarged, a counter-opening made, the whole canal opened, and it must, especially, be treated according to the rules given for fistulous passages (*par.* 66.)

327. If stabs penetrate parts of tough structure, or into those surrounded by unyielding aponeuroses, severe symptoms may be produced when swelling comes on, which can only be relieved or removed by suppuration of the wound.

328. Punctures of tendons exhibit no particular symptoms; but in tendons enclosed in sheaths severe inflammation usually takes place.

The injury of large nerves in stabs always causes severe symptoms. The nerves, for the most part, are only partially divided. A peculiar sensation of numbness occurs in the part to which the wounded nerve is distributed; and along its course a severe pain and inflammatory redness extends above and below the wounded part; the fever is very high; twitchings occur both in the wounded part and over the whole body; the wound, also, may be so highly inflamed as to run into gangrene.

The *treatment* must be strictly antiphlogistic; general and local bloodlettings, softening applications, and antiphlogistic medicines, must be employed in connexion with narcotics, especially calomel with opium. The last remedy, according to some, should be the division of the nerve (?).

If vessels are wounded in stabs, and the bleeding cannot be stanched by suitable pressure, and by the application of cold water, the wound must be enlarged, the injured vessel laid bare and tied, or a ligature applied above and below the wounded part.

Descot, P. S., Dissertation sur les Affections Locales des Nerfs. Paris, 1825. 8vo.

Swan, J., A Treatise on Diseases and Injuries of the Nerves. 2nd Edit. London, 1834. 8vo.

Bell, G.; in the Edinburgh Journal of Medical Science. October 1826.

329. The enlargement of a punctured wound, which was formerly made in every case for the purpose of converting it into an open wound, the

cutting through half-divided parts, and so on, must only be undertaken (as it is evident from what has been said) for the removal of foreign bodies, or to effect the stanching of blood; or, in parts of an unyielding texture, to prevent the strangulation of deep-seated structures. And, in like manner, the introduction of a seton, which was formerly so common, is now restricted to those cases where the walls of the fistulous passage are become callous.

Compare sec. 66.

III.—OF TORN OR LACERATED, AND BRUISED OR CONTUSED WOUNDS.

(*Vulnera lacerata et contusa,* Lat.; *Gerissene und Gequetschte Wunden,* Germ.; *Plaies contuses et déchirées,* Fr.)

330. Torn Wounds are those in which parts are subjected to the greatest degree of stretching before they actually separate; Bruised Wounds such as are produced by blunt instruments.

331. These wounds agree with each other in the disturbance effected in the vitality of the divided parts, by severe bruising, stretching, and tearing. Their form and surface is always irregular; their edges are uneven and hang down in flaps; whole pieces may be torn off the body. In consequence of the bruising and stretching the parts lose their sensibility and irritability; therefore, at first these wounds smart little, and their edges do not retract. They are accompanied with little and frequently with no bleeding, even when large vessels are injured; but much swelling, pain, inflammation and fever soon take place after these injuries. Very frequently they are accompanied with severe shock, which will be presently considered in Gun-shot Wounds. The inflammation may quickly run into gangrene, which spreads the more speedily in proportion as the surrounding parts have suffered more severely from the shock. Nervous symptoms commonly take place in these wounds, but especially in those which are torn. The suppuration may become exhausting.

332. Only in wounds without much bruising or tearing can union be attempted; the edges of the wound are then to be brought together with sticking plaster, *but without using any force for that purpose.* Generally only the bottom of the wound will partially hold together, and the rest unites by suppuration and granulation. Severely bruised and torn wounds, which heal only by suppuration, must be lightly covered with charpie, confined with strips of sticking plaster, or with a loosely applied bandage.

The other *treatment,* both general and local, must be strictly antiphlogistic. From the first, cold fomentations must be constantly employed; and general bleeding, with the repeated application of leeches if the inflammation be great. If much swelling and tension occur, warm, softening poultices should be employed, and when suppuration comes on, the wound must be treated according to the previous rules.

The removal of foreign bodies, with which these wounds are frequently complicated, requires especial attention.

As to the needfulness of enlarging the wound, as to its complication with broken bones, and the necessity for amputation, what is said in reference to these points in gun-shot wounds will apply here.

[When, as occasionally happens, large pieces of skin are torn or stripped down from the parts beneath, it becomes an anxious point with the surgeon to satisfy himself as to what may be the expected result.

From frequent observation I think I may say that torn wounds of the scalp more often do well than those of other parts. I have several times seen large flaps torn down, and in more than two or three instances nearly half the scalp torn down, which have united without difficulty, with or without any abscess forming here and there during the progress of the cure, even in cases where the cellular tissue has been so daubed with mud or sand that it has been sponged off with the greatest difficulty. Such cases are, however, to be much dreaded from cellular inflammation and sloughs, which commonly ensue, and from the participation of the membranes of the brain with the external injury.

When large portions of skin are stripped down from the limbs, there is the greatest danger of the whole piece sloughing, for the vessels of the parts beneath being all torn through are incapable of effecting adhesive union, and the skin itself is not sufficiently vascular for its own support, except close to its remaining attachments. The result of this is a large destruction of the skin and a large sloughy surface beneath, for the throwing off of which greater calls are made upon the constitution than it can answer to; and the patient either dies in a few hours of the shock, or is cut off after a few days with typhoid symptoms. In such cases, in adult persons, my observation both in my own practice and that of others, induces me to recommend amputation as a general rule. Only in very young persons does it seem to me to admit of a moment's hesitation; but as regards them, every possible chance of their being able to struggle through the consequences of the injury should be well considered, for daily experience shows how great are the powers of Nature in youth to repairing injuries which would assuredly destroy adults.—J. F. S.]

333. Bruises without producing separation of the skin may injure the underlying parts severely, and tear the cellular tissue and blood-vessels, by which outpouring of blood into the cellular tissue may ensue. Such extravasation of blood, even if accompanied with fluctuation and pulsation, is often quickly resolved; but if not, the swelling bursts, blood mixed with pus is discharged, and healing by granulation ensues.

These bruises are at first to be treated antiphlogistically, and cold applications used. When the inflammation and swelling diminishes, volatile lotions of camphorated spirit, soap spirit, *aqua vulneraria*, water and sal volatile, or poultices of aromatic herbs, may be used. If a large artery be wounded, it may be necessary to expose and take it up. If the swelling do not disperse, but goes on to suppuration, it must be treated as an abscess.

[The effusion of blood from severe bruising is frequently great and so rapid as to lead often to the supposition of an artery being torn. The patient's condition, however, is the best means of solving the difficulty; if the swelling be large, but after the first shock the pulse continue little disturbed, and the countenance not pallid, and after a few hours the swelling cease to increase, it may be presumed that the extravasation is merely from the small arterial branches and veins. The quantity of serum in these cases generally far exceeds the mass of the clot, and the consequence is that very distinct fluctuation, like water in a bladder, often pervades the greater part of the swelling and continues for some days in proportion to its size. Suppuration occasionally happens in these cases, but it is not of frequent occurrence. If an artery of any material size be torn, the swelling continues gradually increasing, and is generally much more firm, and little fluctuating, except in the immediate neighbourhood of the injured vessel, the effusion in this case being entirely blood, and coagulating soon after it has been poured out. If left alone the continued distension will cause gangrene.

In the ordinary run of severe bruises, even with much effusion, I prefer a warm linseed-meal poultice, or hot moist flannel, to cold applications, as the warmth and moisture are generally most agreeable to the patient's feelings, by suppling the skin and exciting perspiration on the surface. If the tension be very great leeches should be applied freely, and repeated if necessary. If a large artery be injured it must either be tied or the limb amputated; but, in either case, the patient is in some jeopardy of gangrene, from the distension of the soft parts, which has occurred.—J. F. S.]

IV.—OF GUN-SHOT WOUNDS.

(*Vulnera sclopetaria*, Lat.; *Schusswunden*, Germ.; *Plaies par armes à feu*, Fr.)

PARÉ, A., Manière de traiter les Plaies faites par arquebuses, flèches, etc. Paris, 1551. 8vo.

GALE, THOMAS, An excellent Treatise of Wounds made with Gunshot, in which is confuted both the grose error of JEROME of Brunswicke, &c., in that they make the wound venomous, which cometh through the common powder and shotte. And also, there is set out a perfect and true Methode of Curinge those Woundes. London, 1563. 8vo.

CLOWES, WILLIAM, Aprooved Practise for all young Chirurgions concerning Burnings with Gunpowder and Woundes made with Gunshot, Sword, &c. London, 1588. 4to.

WISEMAN, RICHARD, A Treatise of Gunshot Wounds; in his Eight Chirurgical Treatises. London, 1676. folio. 4th Edit., 1705, here used.

BROWN, JOHN, A Compleat Discourse of Wounds, both in general and particular. As also a Treatise of Gunshot Wounds in general. London, 1678. 4to.

LE DRAN, Traité, ou Réflexions tirées de la pratique sur les Plaies d'Armes à feu. Paris, 1740. 4to. Amsterdam, 1741. 8vo., here used.

LOUIS, A., Cours de Chirurgie pratique sur les Plaies d'Armes à feu. Paris, 1746. 4to.

RAVATON, Chirurgien d'armée, ou Traité des Plaies d'Armes à feu et d'Armes blanches. Paris, 1768. 8vo.

SCHMIDT, Preissschrift von der Behandlung der Schusswunden. Wien, 1788.

PERCY, Manuel de Chirurgien d'armée, ou Instruction de Chirurgie Militaire sur le Traitement de Plaies, et spécialement de celles d'Armes à feu : avec la méthode d'extraire de ces plaies les corps étrangers, et la description d'un nouvel instrument propre à cet usage. Paris, 1792.

HUNTER, JOHN, A Treatise on the Blood, Inflammation, and Gun-shot Wounds. Edited by E. HOME. London, 1794. 4to.

DUFAUART, Analyse des Blessures d'Armes à feu, et de leur Traitement. Paris, 1801. 8vo.

LOMBARD, Clinique Chirurgicale des Plaies faites par Armes à feu. Strasbourg, 1804. 8vo.

GUTHRIE, G. J., On Gun-shot Wounds of the Extremities requiring the different Operations of Amputation; with their After-treatment. London, 1815. 8vo. 3rd Edit. 1827.

THOMSON, DR. JOHN, Report of Observations made in the British Military Hospitals in Belgium, after the battle of Waterloo, with some Remarks on Amputation. 8vo. Edinburgh, 1816.

HENNEN, JOHN, Observations on some important points in the Practice of Military Surgery, and the arrangement and police of Hospitals. Edinburgh, 1818. 8vo. 2nd Edit. 1820.

DUPUYTREN, Des Blessures par Armes à feu; in his Leçons orales de Clinique Chirurgicale, vol. ii. p. 417.

Besides these the treatises of BOUCHER, BORDENAVE, DE LA MARTINIÉRE, and FAURE, in the Mémoires de l'Académie de Chirurgie, and the greater number of the writers on Wounds in general, already quoted.

334. Gun-shot Wounds are those produced by hard, usually metallic bodies, as balls of various size, pieces of lead and so on, projected by the explosion of gunpowder. They are therefore, in the highest degree bruised wounds. The violence with which the body causing the division, of organic parts acts, is so great that, as a consequence of the immense bruising and tearing, it is always accompanied with disorgzaniation, that is, with a slough.

["Wounds of this kind," says HUNTER, "vary from one another, which will happen, according to circumstances. These variations will be in general according to the kind of body projected, the velocity of the body, with the nature and peculiarities of the parts injured. The kind of body projected, I have observed, is principally musket-balls, sometimes cannon-balls, sometimes pieces of broken shells, and very often, on board of ship, splinters of wood. Indeed, the effects of cannon-balls on different parts of the ship, either the containing parts, as the hull of the ship itself, or the contained, are the principal causes of wounds in the sailor; for a cannon-ball must go through the timbers of the ship before it can do more execution than simply as a ball, (which makes it a spent ball,) and which splinters the inside of the ship very considerably, and moves other bodies in the ship, neither of which it would do if moving with sufficient velocity: musket or cannon-balls seldom do any immediate injury to those of that profession." (p. 523.)

Dupuytren observes:—"The effects of gun-shot depend on two principal circumstances; the manner in which the gun has been charged, and the distance at which it has been fired. If a gun be loaded with powder only, without being rammed down, its discharge makes little noise, but is quite sufficient to bruise the skin severely, if its contents be received at a short distance. If the gun, though loaded only with powder, have been more or less tightly rammed, its effects vary according to the degree of resistance, and the distance of the body struck; of which I witnessed the following example:—Two persons quarrelled, one of the two, excited by rage, discharged a gun loaded with powder only into the belly of the other, who dropped dead on the spot; the distance between them being only one or two feet. On examining, to ascertain the cause of death, we found the clothes torn, the wall of the belly pierced with a hole about an inch in diameter, and the intestine opened; the gun-wadding was in the middle of the belly, and there was not any other opening: it was ascertained that the gun contained only powder. I have known many other similar instances. Very often suicides, in the trouble and agitation by which they are possessed, forget to put the bullet into the pistol. The different parts of the walls of the mouth are violently distended by the rarefaction of the air. Sometimes the wadding passes through the palate. If the shot pass backwards, the vertebral column is certainly not damaged, but the soft palate is torn, and sometimes even the lower jaw is broken. * * * Small shot of different sizes act in two ways, either as they strike *en masse*, and, as it is said, make a bullet, which depends on the quality of the gun and the little distance of its aperture, or whether the shot spread and fall singly. In the former case its effect is very violent, and produces upon the living body results more serious even than a bullet. In this way the son of Marshal Moncey was accidentally killed; and every sporting season adds fresh victims, either of imprudence or awkwardness. Very frequently a single bullet will pass through the lung without producing death, whilst a charge of shot tears the organ to pieces, and infallibly destroys the party. In the second case, that is if the shot are received at a distance, it is very rare that any serious consequences ensue, unless the part hit be of great importance. An eye, struck by a single shot, is almost always lost without remedy. If the heart, stomach, or intestines, be struck, serious mischief may ensue; but these projectiles rarely penetrate farther than the subcutaneous cellular tissue." (p. 419–422.)

I have had two cases under my own care, in which the former kind of accident occurred. In the one, a man received the whole charge of common small shot from a fowling-piece, at the distance of a very few yards, on the upper outer part of the thigh, near the great trochanter, by which a single round hole, about an inch in diameter, was produced, with but little bruising. The accident had occurred about two hours before he came to the hospital, having been brought from a distance of three miles. He was in a state of collapse when he arrived, and died very shortly after his admission. On examination, the upper part of the thigh-bone was found broken to pieces, and the muscles in shreds; the femoral vessels (if I recollect, for I cannot find any note of the case) were torn asunder. The hæmorrhage had been free. The second case was under my care last year:—A lad, in whose pocket a pistol discharged and shot him in the fore and inner part of the thigh, about the middle, producing a wound about the size of a halfpenny. The pistol was loaded with shot, and he said he had a sixpence in his pocket, which it was thought might have entered the wound. Suppuration commenced on the third day, the slough separated on the eighth, and suppuration was free. On the ninth day two shots were discharged, and on the day following a large piece of wadding, which left open a long sinus extending nearly to the knee. On the eleventh day another piece of wadding was discharged; and on the twentieth, after some pain along the thigh up to the groin, a second large mass of wad came away. By the thirty-second day the discharge of pus had ceased, and the wound had healed to the size of a sixpence; but a week after it became irritable, and pain extended up the thigh. The sore became more irritable and spread to the size of a crown-piece, and he seemed running fast into a hectic state; but on the forty-third day two more shot were discharged. Immediately he began to improve, and in the course of five weeks he was perfectly well. I have several times seen persons peppered with shot, as it is called, from a fowling-piece discharged at a distance, which, as DUPUYTREN states, lodged in the subcutaneous tissue, and were of little consequence; some being discharged by suppuration, or removed by hand, whilst others remained quiet where they were lodged.—J. F. S.]

335. Gunshot wounds, like bruised and torn wounds, are at first accompanied with slight pain (1). They bleed little, or not all; but the bleeding differs according to the way in which the artery is divided. If a large artery be very quickly divided by a bullet, the bleeding is severe; but, on the contrary, scanty, if the artery be more bruised and torn by the diminished speed of the bullet (2). From the same circumstances the form of the shot-wound varies: with a quick ball it often rather resembles a cut or stab; but a weak ball causes greater bruising, tearing, ecchymosis, and so on. Most commonly a greater or less degree of *shock* of the wounded part, or of the whole body, is connected with gun-shot wounds, especially if the ball strike above, or if the injury be in the neighbourhood of any important viscus. The shock consists in a diminished sensibility, or complete numbness of the injured part, or of the whole body; in faintness, trembling, cold sweats, vomiting, giddiness, small pulse, and so on (3). The symptoms which come on at a later period in shot-wounds are active inflammation and swelling, fever, gangrene, nervous symptoms, and copious suppuration (4).

[(1) "It has been supposed," says GUTHRIE, "that gun-shot wounds are not painful at the moment of infliction. This, as a general principle, is erroneous, although in many the pain is but trifling, whilst in others it is severe, and in some few rare instances the patient has been unconscious of the injury. (p. 3.) I am induced to conclude, from many considerations, that the greater the velocity with which the projectile is impelled, the rounder and smaller the size, and the less the resistance opposed, the less will be the sensation of pain produced in the sufferer. But even this opinion must be received with considerable latitude; and a cannon-ball will sometimes completely destroy the internal texture and life of a part, without tearing the skin or causing much pain, and yet the shot causing such injury have usually lost the greater part of the velocity with which it was originally propelled. A musket-ball merely impinging against a soft part, without rupturing the skin, invariably causes much more inability, than if it had actually entered or passed through it." (p. 5.)

(2) "According to theory," says GUTHRIE, "a gun-shot wound being a contused wound, ought not to bleed, in the first instance, because the parts are dead or deadened; and, if it should bleed, some great blood-vessel must be injured; whilst according to the same authority, secondary hæmorrhage was to be expected and dreaded at the moment of the separation of the sloughs. * * * Facts are often opposed to theory, and in nothing more than on this point; for although some gun-shot wounds bleed but little at the moment of infliction, there is in the greater number more or less loss of blood, and occasionally in considerable quantity, although there be no vessels of importance injured. In wounds of the face and neck, the quantity lost is often considerable, and the clothes are generally covered with it. If the ball inflicting the injury should have come in contact with any solid substance, previously to its touching the human body, it may have become of an angular, irregular, and even flattened form; the wound will be, in consequence of this change in the ball, more lacerated than contused, and the loss of blood in all probability greater. * * * The bleeding from a simple flesh wound soon ceases, and does not return except some violence be done to the part; whilst in a case of a wounded artery, it sometimes continues until the patient dies, which is frequently the case when a large artery is partially divided. If the artery be completely divided, a considerable quantity of blood is quickly lost, and the patient may also die; but, in general, syncope or a state nearly allied to it supervenes, and the hæmorrhage ceases spontaneously. The same thing occurs when a limb is carried away by a cannon-shot, and proves the safe-guard of the patient's life; for serious and destructive bleeding has ceased, in most cases, before a tourniquet can be applied: and indeed, in the greater number of cases, they are of no use whatever, for after the hæmorrhage has been spontaneously suppressed, it does not in general return; and whenever it does return, the patient's life will certainly be lost, unless proper and effective assistance be at hand." (pp. 6, 7.)

(3) With regard to the shock, GUTHRIE makes the following very interesting observations:—"When an organ of importance has been injured, and the blow severe, as by a cannon or grape shot, or shell, or from the fracture of a bone, and even from the attention being directed to the receipt of an injury from the situation in which the soldier may be placed, a peculiar constitutional alarm ensues, in a much greater degree than would follow an injury of equal magnitude precisely in the same spot from any other cause. It affects alike, although not in an equal manner, the coward and the brave, the man of learning and the unlettered soldier. * * * On the receipt of a wound which has the appearance of being fatal, or if circumstances of situation can give rise to such an idea in the patient's mind, the constitutional affection is often as manifest at first as when some vital organ has been injured; but it subsides much sooner, and offers us, in doubtful cases, a diagnostic symptom of the greatest value and certainty. * * * The continuance of the constitutional alarm or shock ought to excite great suspicion of serious injury; and when wounds have been received in such situations, or bear such appearances as render it doubtful whether any parts of vital importance have been injured or not, the surgeon may sometimes make up his mind as to the fact from it alone, when other symptoms more indicative of the injury are wanting; and under all such circumstances he ought to be particularly guarded in the prognosis or opinion given to the patient or his friends, although every other appearance should even lead him to suppose the injury to be less serious." (pp. 10, 11.) HENNEN remarks, that "some men will have a limb carried off or shattered to pieces by a cannon-ball, without exhibiting the slightest symptoms of mental or corporeal agitation; nay, even without being conscious of the occurrence; and when they are, they will coolly argue on the probable result of the injury; while a deadly paleness, constant vomiting, profuse perspiration, and universal tremor, will seize on another on the receipt of a slight flesh-wound. This tremor, which has been so much talked of, and which, to an inexperienced eye, is really terrifying, is soon relieved by a mouthful of wine or spirits, or by an opiate, but above all by the tenderness and sympathising manner of the surgeon, and his assurances of his patient's safety." (p. 33.)

(4) "Gun-shot wounds, from whatever cause," observes HUNTER, "are in general contused wounds, from which contusion there is most commonly a part of the solids surrounding the wound deadened, as the projecting body forced its way through these solids, which is afterwards thrown off in form of a slough, and which prevents such wounds from healing by the first intention or by means of the adhesive inflammation, from which circumstance most of them must be allowed to suppurate. This does not always take place equally in every gun-shot wound, nor in every part of the same wound; and the difference commonly arises from the variety in the velocity of the body projected; for we find in many cases where the ball has passed with little velocity, which is often the case with balls even at their entrance, but most commonly at the part last wounded by the ball, that the wounds are often healed by the first intention. Gun-shot wounds, from the circumstance of commonly having a part killed, in general do not inflame so readily as those from other accidents; this backwardness to inflame will be in the proportion that the quantity of deadened parts bear to the extent of the wound; from which circumstance the inflammation is later in coming on, more especially when a ball passes through a fleshy part with great velocity, because there will be a great deal deadened in proportion to the size of the wound. * * * On the other hand, where the ball has fractured some bone, which fracture in the bone has done considerable mischief to the soft parts independent of the ball, then there will be nearly as quick inflammation as in a compound fracture of the same bone, because the deadened parts bear no proportion to the laceration or wound in general." (pp. 523, 24.)

Instances, however, do now and then occur, in which the wounds made by gun-shot are perfectly regular and, more or less, like those made by a cutting instrument. Several such have been mentioned by H. LARREY (*a*); and in one case, a fragment of shell carried away a piece of the skin of the chest, leaving a regular elliptical wound, resembling that produced by amputation of the breast. The edges were brought together without sutures, and was quickly cured. (p. 138.)]

336. The direction of the shot-wound varies extraordinarily, and depends on the speed of the ball, on the different thickness and resistance of the parts which the ball strikes. Its course is usually indicated externally by a dark streak, or a certain emphysematous crackling may be observed by feeling along the shot track. Experience has proved that

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(*a*) Hist. Chir. du Siége de la Citadelle d'Anvers. 8vo.

balls can travel not merely round the convex surface of the walls of the different cavities of our body, but even completely around their concave surface.

337. The following general kinds of injury from shot wounds may be distinguished:—

1. The ball may not penetrate, but injure deep-lying parts in various ways, so that muscles and other soft parts may be bruised, and bones even crushed, without the skin being injured. (*Wounds by wind of the ball, or by rebound of shot.*) This occurs, either because the ball has not sufficient power to penetrate, or because it strikes the body very obliquely (1).

2. The ball penetrates, but remains lodged, and the shot passage has but one opening (2).

3. The ball passes through: the shot passage has two apertures, the one by which the ball has entered, pressed in, as large or even smaller than the ball, and the circumference of the other larger, outspreading, irregularly torn, and little bruised (3).

4. The ball has taken off the greater part or the whole of the limb.

Shot-wounds are also further distinguished into *simple* and *complicated*, according as merely soft parts of minor importance, or vessels, nerves, and bone are injured.

(1) The opinion that the so-called *wounds from the wind of balls* is produced by the compression of the air, by the electric condition of the ball during its passage through the cannon or through the air has been long known as incorrect. Recently Rust (*a*) and Busch (*b*) have again taken up wounds by the wind of balls, but have not ascribed their operation to the pressure of the air, but to the vacuum momentarily produced by the passage of a ball of large calibre, by which a turgescence in the part takes place externally towards the vacuum. This opinion, however, does not seem to me agreeable to the laws of physics.

["It very often happens," says Hennen, "that while all is smooth and sound to the eye, or there is perhaps only a slight erosion of the skin, a very serious injury has been done to the subjacent soft parts." If the vitality of the part be entirely destroyed, "a circumscribed tumour, soft and pulpy to the feel, forms on the spot; the skin, at first of a natural colour, gradually assumes a dusky shining hue, and either sloughs off, leaving beneath a dark glossy, flabby, muscular mass, discharging tenacious bloody sanies, or else a chain of ill-conditioned abscesses forms, which soon run into one another, and burrow deep beneath the disorganized mass of skin and muscle, if not prevented by timely evacuation." (pp. 91, 2.)

(2) "These appearances," according to Guthrie, "are by no means constant, or so strongly marked. If the ball impinge with violence against a surface capable of offering considerable resistance, the entrance will be well-marked. If the resistance offered be nearly equal to the momentum, the ball will lodge or pass through with a well-marked exit; but if the velocity and impulse be greatly superior to the resistance, the exit, although not a depression, will often partake in the appearances of the entrance, the velocity with which the ball passes through the part overcoming so instantaneously the resistance, that the laceration, which would otherwise take place in the passage of the ball from the dense medium of the body to the rarer one of the air, does not occur." (p. 18.)

Dr. Thomson says:—"It is no uncommon thing for a ball in striking against the sharp edge of a bone to be split into two pieces, each of which takes a different direction. Sometimes it happens that one of the pieces remains in the place which it struck, while the other continues its course through the body. Of a ball split by the edge of the patella, I have known one half pass through at the moment of the injury, and the other remain in the joint for months without its presence there being suspected. In the same manner I have known a ball divided by striking against the spine of the scapula, and one portion of it pass directly through the chest, from the point of impulse, whilst the other moved along the integuments, till it reached the elbow." (p. 37.) Similar to this is the case, mentioned by Dupuytren, of "a man who received a shot, and the ball entering the lower part of the right leg was split into two upon the sharp edge of the

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(*a*) Rust's Magazin, vol. vii. part iii. p. 344. (*b*) Ibid, vol. x. part iii. p. 372.

shin-bone. Both halves passed the calf of the leg a little apart, and lodged in the thickness of the other leg, which was behind. Such cases are not rare." (p. 429.)

(3) Upon this point GUTHRIE observes:—" If there be but one opening to be seen, it is usual to suppose the ball has lodged; but this does not always follow, although the finger may pass into the wound for some distance * * * It sometimes happens in injuries of the head, that the ball drives a piece of bone nearly of its own size into the substance of the brain, although it does not actually penetrate with it, but falls to the ground. A ball will often be turned, as is well known, by a slight resistance which is not directly opposed to it; but if the resistance be greater than the momentum, and offered by an elastic body, the ball may retrace the passage it has made; as, for instance, when opposed by the cartilages of the ribs, or any strong tendon." (p. 19.)

338. Shot-wounds are most generally complicated with the presence of foreign bodies in the cavity of the wound. These may be, the ball itself, the wadding, pieces of clothes, splinters of bone, and so on. Slow balls usually drive a larger piece of the clothes into the canal of the wound, than balls which still move quickly, and where usually but a single tear, corresponding to the size of the ball, is found.

339. The prognosis of gun-shot wounds is the more serious as the wound is less simple; the greater the destruction, which the ball has produced by its size and swiftness, the more sensitive the wounded person is, and the more important is the injured part. The degree of the shock, the severity of the inflammatory symptoms, mortification, and copious suppuration, are in shot-wounds generally to be dreaded; and these evils are increased by the condition in which the wounded are commonly found, their crowding together in hospitals, the prevalence of contagious disease, the danger of hospital gangrene, of tetanus, and so on.

340. If the injury in shot-wound be not such as at once to require the amputation of the limb, or the stanching of a severe bleeding, the first indication is to examine the wound carefully, in order to ascertain its course and the presence of any foreign body: all which has been mentioned (*pars.* 275 and 306) in regard to the examination of wounds and the extraction of foreign bodies applies here.

The enlargement of the shot-wound, in former times generally practised, may, besides in the cases where the discovery and extraction of foreign bodies render it feasible, be necessary for the following reasons:—1. In shot-wounds of parts covered with a tough aponeurosis; for instance, on the back of the neck and spine, on the shoulder, fore-arm, hand, on the upper and outer part of the thigh, on the leg, and on the sole of the foot. In these cases the aponeurosis must be always more extensively cut into, than the underlying parts, whereby the dreaded strangulation of the parts, in the ensuing swelling, can, simply and alone, be prevented. 2. In shot-wounds in very yielding parts, where a great outpouring of blood always takes place, as in the scrotum. 3. When fibrous parts and nerves are only half divided, and much bruised. 4. In bleedings for the purpose of laying bare and tying the vessel. 5. When a bullet is lodged in a joint, and the wounded person resists amputation. 6. In wounds penetrating cavities, for the purpose of emptying the extravasated blood.

Enlargement of the wound may also be necessary at a subsequent period, in order to furnish a proper outlet for pus, or for the removal of loose splinters of bone or other foreign bodies. In making the enlargement a button-ended bistoury is to be introduced upon the forefinger of the left hand, or upon a hollow director, and the wound enlarged in such direction and extent as the position of the part and the individual case may require.

When it has been ascertained, by examining the wound, that no large vessel is injured, the most certain remedy to stanch the bleeding is *suitable compression*. When it is impossible, by enlarging the wound, to take up a large vessel in the wound itself, the artery must be laid bare and tied above the wounded part.

["If the ball has passed through the fleshy part of the arm, thigh, or buttock, we do no more," says HENNEN, "than sponge the part clean, place a small bit of folded lint on each orifice, which we retain by two cross slips of adhesive plaster, and lay over two or three turns of a roller. The ball will frequently have passed nearly through the limb, and be retained only by the elasticity of the common integuments; these we cut upon and extract it at once; and we should lay it down as a rule not to be deviated from, to extract on the spot every extraneous body that we possibly can, either by the forceps alone or with a bistoury" (pp. 33, 4.)

341. The remaining *treatment* of gunshot wounds does not differ from that of bruised wounds. The orifice is to be covered with a mass of soft charpie, which is to be slightly fastened with a bandage, resolving applications of cold water, solution of muriate of ammonia, and so on, are to be laid over the neighbourhood of the wound. The general treatment must be strictly antiphlogistic, according to the state of the constitution and the inflammatory symptoms present. But when the shock is severe, stimulating and reviving remedies must be employed in the first instance.

342. If active inflammation and swelling exist, instead of cold applications, warm, softening poultices should be employed to further suppuration. When this takes place, the slough in the shot-passage separates, and the vessels, which had been closed in many instances begin to bleed. The direction of the shot-passage must draw the attention of the surgeon to the possibility of this occurrence. The patient should at this time be surrounded with clever assistants, and, if bleeding take place, it must be stopped by pressure, or by tying the vessel. If the bleeding be connected with inflammatory congestion, cold applications and blood-letting must be employed.

[GUTHRIE says:—"On the separation of the sloughs a little blood may occasionally be lost, but it is generally caused by the impatience of the surgeon, or the irregularity of the patient, and seldom requires attention. Sometimes at this period, that is, from the eighth to the twentieth day, a large artery will give way from sloughing or ulceration; but the proportion of cases requiring the ligature of arteries will not be greater than three or four in a thousand taken indiscriminately, exclusive of hæmorrhage caused by hospital gangrene, &c., which, as they may almost always be avoided by proper care and management, cannot with propriety be considered as legitimate causes." (p. 8.) SAMUEL COOPER's statement, in regard to bleeding from arteries on the separation of sloughs, differs materially from that of GUTHRIE. He says (*a*):—"In the beginning there may even be little hæmorrhage, though a considerable artery be so hurt that it afterwards sloughs, and a dangerous or fatal bleeding arises. Thus, in one of my own patients, who had received a musket-ball through the ham, the popliteal artery gave way about ten days after the injury and compelled me to take up the femoral artery; and, in the Elizabeth Hospital at Brussels, amongst the patients under the care of my friend Mr. COLLIER and myself, about a week after the battle of Waterloo, the cases of hæmorrhage, on the loosening of the sloughs, were numerous." (p. 632.)

DUPUYTREN states, that consecutive hæmorrhage "occurs under two different circumstances, either the artery has been completely or in part only divided. In the first case, the scar produced by the shot and the clot of blood which forms in its cavity, up to the first collateral branch, obliterates and suspends the circulation throughout its whole extent. But it often happens that, under the influence of certain causes, the circulation speedily resumes considerable activity, the clot is pushed off, the scar overcome and hæmorrhage takes place. In the other case, the obstacles which prevent the bleeding resist till the very moment when the whole internal surface of the wound, and consequently the torn and disorganized parts of the artery are detached and thrown off by the suppuration. But at this time, if the end of the artery be obliterated only to a short

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(*a*) Surgical Dictionary. Seventh Edition.

distance, if its adhesions be not sufficiently firm, if the careless movements of the patient destroy this union and so on, the artery is opened and the patient exposed to more or less imminent danger. These consecutive bleedings usually occur about the tenth, fifteenth, and even twentieth day, without any premonitory symptoms, except sometimes a sero-sanguinolent oozing from the wound." (pp. 465, 66.)]

343. The local and general *treatment* during suppuration must be always proportioned to the vital disposition and the powers of the wound. Particular care must be had for pure air, and for the function of the bowels. Often during suppuration inflammation recurs, the suppuration is bad, or perfectly suppressed; the wound, when almost entirely closed, breaks out again repeatedly. In such cases foreign bodies, especially splinters of bone, are usually retained which must be removed as soon as possible. If this cannot be effected in the usual way, the introduction of a seton is the most preferable means to obtain a proper outlet for the pus, and to promote the escape of the splinters of bone.

["In cases where the separated pieces (of bone) lie loose, and cannot easily be got at by the forceps, setons have been employed with some advantage, for the purpose of bringing them away; and when judiciously applied, and not carried to such a length as to affect sound pieces of bone with caries, and thus produce what they meant to remove, they may often be usefully had recourse to. Staff-Surgeon **Boggie** showed me," says **Hennen**, "some cases at Brussels in which he had employed the seton with success, and an account of a case in which he adopted the plan is published in the 7th volume of the Medico-Chirurgical Transactions. Dr. **Arthur**, Surgeon to the forces, has also successfully used them in some old cases at the General Hospital, Chatham. But to the indiscriminate introduction of setons in gun-shot injuries, either of the bones or soft parts, I cannot help entertaining strong objections. They are at best but a clumsy and unmanageable substitute for the knife, and in numerous instances much more painful and irritating." (pp. 131, 32.)]

344. If the shot-wound be connected with fracture of bones, and immediate amputation be not indicated, the treatment is always very tedious and difficult. When the wound is enlarged, according to circumstances, for the extraction of loose pieces of bone, and the arrangement in their place of the pieces still attached, we may proceed to put up the fracture, and the application of a contentive bandage by means of **Scultetus**'s bandage and a large wooden splint, if there be not any great swelling by contraction of the muscles; but, if this be the case, or if the wounded person have yet to be moved, in which case this bandage cannot prevent the displacement of the ends of the bone, the limb should be put in the half-bent position, in which the muscles are for the most part relaxed; it must be wrapped up in **Scultetus**'s bandage, and the ends of the bone protected against much displacement. As soon as the inflammatory symptoms are diminished by the general and local treatment, attention must be paid to the management of the fracture. Actual extension of the limb with **Dessault**'s splint, with the machines of **Boyer**, **Sauter**, and others, may be employed with much advantage; but must be used with great caution. The causes which here especially delay the union of the ends of the bone are, too copious suppuration, improper arrangement of the fracture, foreign bodies, death of the bone (1). If the suppuration be so great that the powers of the patient fail, amputation must be prescribed at the proper time.

["The disposition to necrosis in gun-shot injuries of the bones, a circumstance of daily occurrence in military hospitals, is," says **Hennen**, "always tedious, highly troublesome, and frequently dangerous. The precise time of its commencement is not easily ascertained: I have detected it on the twenty-first day from an injury; but it is more frequently a disease of the advanced periods. It is most frequent in bones covered by their soft parts, while caries takes place more readily when they are exposed to the air, Where the periosteum is removed for any extent by a gun-shot or lacerated wound, or suffers disorganization afterwards from any cause, whether inflammation, ulceration or erosion; or where the medulla is injured or destroyed, it becomes a never failing occasion of the death of that part of the bone in the immediate vicinity of the injury." (pp. 124, 25.)]

345. In long-continued suppuration, bleeding often occurs from the whole surface of the wound, which commonly retards and very much weakens the patient. These bleedings depend on a weakness of the vessels, and upon a state of thinness of the blood. Local, and general strengthening remedies must be employed; decoction of bark with the mineral acids; care must be taken for pure air and good food; and the wound filled with charpie soaked in a vinous decoction of elm bark with alum and so on. If these means be not beneficial, and sinking be feared, the application of the actual cautery, or tying the principal arterial trunk of the limb, is the only remedy which can be tried, previous to amputation.

346. The decision upon those circumstances in wounds, especially those from gun-shot, which render *amputation* necessary, belongs to the most difficult part of surgery. Not only must the importance of the injury itself be well considered; but also, as these cases for the most part occur in war, in so far as the transport of the wounded, the want of proper care and nursing, overfilled hospitals, and the danger connected with a long sojourn in the hospital, render possible or not the preservation of the wounded limb; and whether perhaps the limb can be preserved only in such a crippled state that it is more inconvenient than useful, and the life of the wounded person is put in the greatest danger by the attempt to preserve the limb.

347. When the condition of the wound is favourable for amputation, it should be performed as soon as possible, at least in the first twelve or twenty-four hours before the secondary symptoms have come on. Experience is against putting off amputation to a later period, as practised by the earlier surgeons.

348. The following are those cases which require amputation on the spot:

1. When a limb is entirely torn off by a ball; as in such an injury, especially when the ball has lost its power, the splitting of the bone commonly extends into the neighbouring joint, the limb must be removed high above the place of injury, or above the next joint (1).

2. If both the soft and hard parts of a limb are so bruised and smashed that gangrene will certainly occur.

3. If, without injury of the bone, the soft parts of a limb, the largest vessels and nerves are mostly destroyed.

4. When the soft parts and bones of a limb, with the largest nerves, are smashed and torn although the principal arterial trunk is not injured.

5. Splitting of the large bones, with tearing of the vessels and bruising of the deep-lying parts, without injury of the external skin (2). Before proceeding to amputation, we must cut down to ascertain the extent of the destruction of the parts.

6. Smashing of joints, especially of the knee and foot-joints, when the capsular ligament is very much torn and the bone split, or when the ball is lodged in the joint and cannot be removed. If the head of the bone be completely separated from its body in the shoulder-joint, the head of that bone may be removed.

[(1) **Hennen** says:—" If, however, the bone is splintered to the very joint, or so close as to excite our fears as to future consequences, we operate beyond it on the upper part of the limb. If the head of the humerus itself is injured, or the shaft splintered, with much destruction of the soft parts, or if the head of the bone alone is left in the glenoid cavity, the rest being carried off, we forthwith take it out of the socket; an operation as simple, if properly planned, as any in surgery; and one which, on all occasions where the bone is injured, is infinitely preferable to amputation lower down. It not unfrequently occurs, that the arm is carried completely out of the socket; and, in this case, very little more remains for the surgeon than to pass a ligature round the arteries, even though they do not bleed, as often happens, and to cut short the leash of nerves, which in this case usually hangs far out of the wound, to bring the lips towards each other by adhesive straps, and to support them by proper compress and bandage." (pp. 38, 9.)

(2) **Hennen** mentions "a species of the comminuted compound Gun-shot Fracture, which, although at first of but little consequence in appearance, is of most serious importance in its results. This occurs where a musket-ball has perforated a cylindrical bone without totally destroying its continuity, and consequently without producing any distortion of the limb, or other symptoms which characterize a fracture. The foundation of infinite mischief is, however, laid; for not only is the shaft of the bone injured, but fragments are carried into and lodged in the medullary canal; and if the limb has been in an oblique position, or the ball has taken an oblique course, these fragments are often driven in to a great distance, and fairly impacted in its cavity, there keeping up a constant and uncontrolable irritation, and destroying both the medulla and its membrane, together with the cancelli, which naturally support it. I have repeatedly seen this separated portion of bone lying in the medullary canal, at the distance of from four lines to an inch and a half from the circular hole formed by the passage of the ball, retaining its shape, its colour, its solidity, while all the surrounding osseous parts were diseased, and formed a spongy discoloured mass of bony granulations around it, the periosteum, for some way, both above and below the wound, being entirely separated from the bone. To attempt to save such a limb is imposing a task upon the powers of nature, which, nineteen times in twenty, she is unable to effect, even under the most favourable circumstances. If a ball has passed through without carrying in any fragments of bone, a case which sometimes happens in the thigh, when the man is standing erect, and the ball has struck the bone fairly and directly, the case is more favourable, than when the wound is oblique as in the arm, which is so often thrown into a variety of postures; and consequently, where there is a greater chance that the channel of the ball should be formed obliquely, and the spicular fragments forced up into the medullary cavity. But even of this favourable variety I have seen only two cases cured, both of persons struck on the centre of the femur, the wound admitting a finger to be passed into the bony ring or perforation, and there to find a clear, unembarrassed, and comparatively simple loss of parts. By far the most frequent result is the loss of the limb sooner or later, after a very tedious and distressing train of symptoms, exhausting to the patient and baffling every endeavour of his attendants." (pp. 133, 34.)

(3) " Balls often pass through or along the bones of the hand or foot, and, except in very severe cases attended with great loss of substance, amputation," says **Hennen** "is not immediately necessary. The strength of the fasciæ covering those parts, and the number of minute bones composing them, will, however, render extensive openings peculiarly requisite. These bones never suffer from necrosis, nor do they ever become regenerated as far as my experience goes; but if the aid of an appropriate supporting splint, assisted by proper bandages, is had recourse to, their loss is soon supplied by a new formation of soft parts, approaching to a cartilaginous nature; and by the approximation of the sound bones to each other. However desirable it may be to save a hand or foot, yet, in severe lacerations, the frequency of tetanic affections should at once lead us to adopt immediate amputation. Gun-shot injuries of the joint of the great toe are always extremely troublesome, and accompanied with excruciating pain, often giving rise to severe nervous affections, and often terminating in tetanus. Amputation of the toe will therefore be the safest mode of treatment, and it should be a general rule to amputate all lacerated toes and fingers, in preference to attempting their preservation." (pp. 154, 55.)]

349. The earlier in these cases amputation is had recourse, to the more successful is the result; but in very severe general shock, or in complete numbing from cold, the wounded person must be first revived with stimulants. When the secondary symptoms have once set in, before amputation is performed, it must be delayed, till after proper treatment the patient

is in a quiet condition at the period of suppuration, at which time amputation should be immediately performed.

[Immediate amputation after severe gun-shot injuries has long been the practice of English army and navy Surgeons, for it would seem in the way it is spoken of by **Wiseman** that even in his time it was a settled proceeding. He says:—"Experience judgeth it commendable, if it be necessary; and in such shattered limbs where there is no hope of preserving the patient's life otherwise. And then it must be done in its proper time, that is to say, suddenly upon the receipt of the wound, before the patient's spirits be overheated, either with pain, fever, &c. * * * But amongst us aboard, in that (the naval) service, it was counted a great shame to the chirurgeon if that operation was left to be done the next day, when symptoms were upon the patient and he spent with watchings, &c. Therefore you are to consider well the members, and if you have no probable hope of sanation, cut it off quickly, while the soldier is heated and in mettle. But if there be hopes of cure, proceed rationally to a right and methodical healing of such wound; it being more for your credit to save one member than to cut off many." (p. 396.) The celebrated French surgeon, **Le Dran**, who published on gun-shot wounds a few years after **Wiseman**, also advocated the early amputation, and lays it down as a rule, "that when the amputation of a limb is indispensably necessary, in the case of a gun-shot wound, it ought to be done without delay." (p. 163.)

Ranby, (*a*) who was serjeant-surgeon to **George** the **Second**, and whom he accompanied in the wars in Flanders, adhered to **Wiseman**'s practice, and says:—"If a wound be of such a desperate nature as to require amputation, (which is always the case when it happens in any principal joint,) it would certainly be of consequence could the operation be performed on the spot, even in the field of battle; lest, by deferring it, an inflammation may come on, which one may very reasonably expect should obstruct a work that ought rarely to be entered upon during the continuance of so calamitous a circumstance. The neglecting this critical juncture of taking off a limb, frequently reduces the patient to so low a state, and subjects the blood and juices to such an alteration, as must unavoidably render the subsequent operation, if not entirely unsuccessful, at least exceedingly dubious." (p. 29.)

It is probable that about this time some dispute had occurred as to the propriety of this practice; for, in 1756, the French Academy of Surgery proposed it as the subject for the prize essay in that year, and in consequence of the paper of **Faure**, an army Surgeon, to which they assigned the reward, they decided in favour of delaying the operation wherever practicable, although from the first it were absolutely necessary. Soon after, this, **Bilguer**, Surgeon-general to the Prussian army, wrote against amputation in general, and permitted *no amputation* in that service. But although his statements were "much applauded, and in some countries held up as doctrines to be followed," yet, from carefully sifting them, and from his own practical experience, **Guthrie** says, that "**Bilguer** on this subject ought never to be quoted as an authority for modern times." (p. 205.)

But neither the recommendation of the French Academy nor **Bilguer**'s anathema seem to have had much influence on the medical officers of the British service, for **Hunter** says:—"In general, surgeons have not endeavoured to delay it (amputation) till the patient has been housed and put in the way of cure; and therefore it has been a common practice to amputate on the field of battle." But to primary amputation **Hunter** was decidedly averse, for he proceeds:—

"Nothing can be more improper than this practice, for the following reasons. In such a situation it is almost impossible for a surgeon, in many instances to make himself sufficiently master of the case, so as to perform so capital an operation with propriety; and it admits of dispute, whether at any time and in any place amputation should be performed before the first inflammation is over. When a case is so violent as not to admit of a cure in any situation, it is a chance if the patient will be able to bear the consequent inflammation, therefore, in such a case it might appear, at first sight, that the best practice would be to amputate at the very first; but if the patient is not able to support the inflammation arising from the accident, it is more than probable that he would not be able to support the amputation and its consequences; on the other hand, if the case is such as will admit of its being brought through the first inflammation,

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(*a*) The Method of treating Gunshot Wounds. 8vo. London, 1774. To **Ranby** the profession of Surgery in this country is much indebted, as it is believed that mainly by his interest and exertions the Surgeons were in 1745 (18 Geo. II.) separated from their connexion with the barbers, and established as a distinct corporation, of which he was the first master, although not a member of the old court, and probably not even a member of the Company of Barbers and Surgeons.

although not curable, we should certainly allow of it, for we may be assured that the patient will be better able to bear the second. If the chances are so even, where common circumstances in life favour the amputation, how must it be where they do not? how must it be with a man whose mind is in the height of agitation, arising from fatigue, fear, distress, &c.? These circumstances must add greatly to the consequent mischief, and cast the balance much in favour of forbearance. If it should be said that, agreeable to my argument, the same circumstances of agitation will render the accident itself more dangerous; I answer that the amputation is a violence superadded to injury; therefore heightens the danger, and when the injury alone proves fatal, it is by slower means. In the first case it is only inflammation; in the second, it is inflammation, loss of substance, and most probably loss of more blood, as it is to be supposed that a good deal has been lost from the accident, not to mention the awkward manner in which it must be done. The only thing that can be said in favour of amputation on the field of battle is, that the patient may be moved with more ease without a limb than with a shattered one." HUNTER, however, doubts any advantage being obtained even on that point. He admits, "it is of less consequence whichsoever way it is treated if the part to be amputated is an upper extremity." And he even goes on to say, "If the parts are very much torn, so that the limb only hangs by a small connexion, then the circumstance of the loss of so much substance to the constitution cannot be an objection, as it takes place from the accident, and indeed every thing that can possibly attend an amputation; therefore, in many cases, it may be more convenient to remove the whole. In many cases it may be necessary to perform the operation to get at blood vessels, which may be bleeding too freely; for the searching after them may do more mischief than the operation." (pp. 561, 63.)

HUNTER's objections to primary amputation do not, however, appear to have had much weight, at least with the army surgeons of his own or the immediately subsequent period, for HENNEN states, on the authority of Dr. PITCAIRN, who served in the expedition to Egypt, "that whenever the surgeons could operate on the field in that country they did so; and for himself, he only lamented that he could not remove more limbs in that situation, having never had a doubt upon the point, and being still more confirmed in the justice of his opinion by the results of the deferred operations." To this HENNEN adds:—"On the first landing of our troops in Portugal, the propriety of the practice was impressed upon the surgeons, as I have been informed, by Mr. GUNNING, then senior Surgeon upon the staff, and subsequently Surgeon-in-chief of the Peninsular army; the practice was constantly followed, and the precept orally delivered from surgeon to surgeon, during the whole period that I served in that country." (p. 43.)

GUTHRIE has ably advocated the practice of early amputation after gun-shot injuries, and makes the following judicious observations, which equally apply to this operation when required by any other accident, and which should never be lost sight of. "The anxiety (shown by the soldiers) to have these operations executed with as little delay as possible, has sometimes been prejudicial; for as much attention must be paid, in my opinion, to avoid operating too soon as too late, and perhaps for a reason quite contrary to that usually received as legitimate for not operating, viz., that the sufferer may have time to recover from the shock of the injury, and approach as near as possible to a state of health; and the farther he is from this state, the greater the chance of a fatal termination. If a soldier at the end of two, four, or six hours after the injury, has recovered from the general constitutional alarm occasioned by the blow, his pulse becomes regular and good, his stomach easy, he is less agitated, his countenance revives, and he begins to feel pain, stiffness, and uneasiness in the part; he will now undergo the operation with the greatest advantage; and if he bears it well, of which there will be but little doubt, he will recover in the proportion of nine cases out of ten in any operation on the upper extremity, or below the middle of the thigh, without any of the bad consequences usually mentioned by authors as following such amputation. If, on the contrary, the operation be performed before the constitution has recovered itself, to a certain degree, from the alarm it has sustained, the additional injury will most probably be more than he can bear, and he will gradually sink under it and die." (p. 216.)

Upon the same point HENNEN also observes:—"The propriety of amputation on the field being admitted, the question naturally suggests itself, what is the proper period? instantly on the receipt of the wound, or consecutively? The practical reply is, *with as little delay as possible.*" But when "an army surgeon finds a patient with a feebleness and concentration of the pulse, fainting, mortal agony, loss of reason, convulsions, hiccup, vomiting, irregular chills, stiffening of the whole body, universal feeling of cold and numbness, sense of weight, change of colour, and other symptoms of collapse, so well described by LE CONTE, he waits patiently for a return towards life: he administers wine, warmth, volatiles; he soothes and he encourages; and when due reaction is established, he performs that humane operation, the utility and necessity of which are now confirmed beyond the possibility of doubt or the influence of cavil." (pp. 45, 6.)

"Inflammation in the seat of the injury," **Guthrie** further observes, "comes on at an indeterminate period, varying in different people. When the injury is high in the thigh, it commences sooner than in the leg or arm, and the symptomatic fever accompanying it is proportionally severe. If, then, after an injury where the alarm has been very great, and the powers of life considerably diminished, so as to have prevented an operation shortly after the accident, some little reaction should take place, the patient should become restless, the pulse quickened, the parts injured painful, the operation should be no longer delayed; for the removal of the diseased parts can only moderate this nervous commotion and prevent delirium and death. * * * If the operation be delayed beyond the first twenty-four hours in some persons, and in others thirty-six hours, pain, heat, tumefaction, and the other constituents of inflammation come on rapidly, attended by increased arterial action, severe nervous twitchings, thirst, heat of skin, general restlessness, delirium, and the patient is soon carried off if the injury has been extensive. Many very severe wounds do not terminate so quickly; the symptoms exist in a less degree, and may be moderated by the antiphlogistic treatment until suppuration is established, and the primary high excitement reduced within the limits of hectic fever depending upon the irritation of incurable parts.

"In any period from the time inflammation has commenced in the seat of injury, and symptomatic fever is established, amputation is performed under very different circumstances than when it has been done prior to their supervention; the parts to be divided are no longer in a healthy state; they have taken on inflammatory action tending to suppuration, and will not unite by adhesive inflammation, as they would have done if they had been divided forty-eight hours sooner. The operation, instead of relieving the symptomatic fever, greatly increases it. It is now really a violence superadded to the injury; and the patient dies, unless very active means are employed for his relief, and even under the most vigorous and attentive treatment it frequently proves fatal, although his life may be prolonged for some days." (pp. 219, 20.)]

350. If amputation be not indicated by the nature of the wound, it is impossible to determine whether and by what consecutive symptoms it may be at a later period required. These symptoms may be: 1. Mortification of the limb.—2. Nervous symptoms, convulsions of the stump, tetanus, when the cause remains in the wound, and cannot in any way be removed.—3. Exhausting suppuration.—4. Bleeding from the whole surface of the wound, which cannot be stanched.

As to the indications for amputation after shot-wounds, and the time at which it should be performed, the following writers are to be especially compared:—

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The Treatises of **Faure**, **Leconte** and **Grillion** upon the question, L'amputation étant absolument nécessaire dans les plaies compliquées de fracas des os, et principalement celles qui sont faites par armes à feu, déterminer le cas où il faut faire l'amputation sur le champ, et ceux où il convient de le différer, et en donner les raisons; in the Prix de l'Académie de Chirurgie.

Larrey, Mémoire sur les Amputations; in Mém. de Chirurg. Milit., vol. ii. p. 451.

Schneider, Ueber die Amputation grösser Glieder nach Schusswunden. Leipz., 1807. 8vo.

Wagner, Versuch einer nähern Bestimmung der Indicationen zur Amputation der grösseren Gliedmassen, besonders nach Schusswunden, in **von Graëfe** und **Walther's** Journal für Chirurgie und Augenheilkunde, vol. i. p. 139.

Hutchison, Copeland, Some further Observations on the subject of the proper period of amputating in Gunshot Wounds. London, 1818.

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V.—ON POISONED WOUNDS.

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Hamilton, Robert, M.D., Remarks on the means of obviating the fatal effects of the Bite of a Mad Dog or other rabid animal, and on the mode of cure when Hydrophobia occurs, etc. Ipswich, 1785. 8vo.

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351. In poisoned wounds, not merely is the connexion of the part divided, but at the same time a peculiar matter is introduced into it, which gives rise to special symptoms. Here belong *the stings of bees and wasps,*

the bite of the viper, and *of rabid beasts.* The poisoning of wounds received in dissection by putrid matter may be also here included.

352. *Wounds in dissection* do not always cause the same symptoms; much in this respect depends on the constitution of the wounded person, on the constitution of the atmosphere, and on the condition of the subject. Cuts are not so dangerous as punctures, and the latter are less dangerous on the front than on the back of the hand. Often merely an active inflammation takes place at the wounded part, with severe pain and swelling of the lymphatic vessels. With these local symptoms (which mostly occur after from ten to sixteen hours) symptoms of nervous fever are often connected. In these injuries the wound must be carefully cleansed, allowed to bleed sufficiently, washed with water, sucked, covered with sticking plaster, and protected, so that it cannot come anew into contact with putrid matter. I have constantly found it very advantageous to wrap up the finger from its tip onwards with a closely applied bandage. If severe inflammation take place, leeches must be applied, warm narcotic remedies used, and when abscesses have formed they are to be opened early. When the symptoms of nervous fever come on, the usual mode of treatment is to be employed.

Many believe that the symptoms after injuries in dissection do not depend on the absorption of putrid matter, but on the constitution of the injured person, wherefore they reject all escharotics. Whether this opinion be well founded or not, I however agree with them in regard to the application of caustic; as thereby irritation and inflammation of the wound, with its consequences, which otherwise would not have happened, would be only too easily produced (*a*).

Shaw, J. (*b*), distinguishes those which occur in dissection, into such as arise from the examination, a short time after death, of subjects which have died from inflammation of the serous membranes, and those from bodies already putrid; the latter of which are least dangerous. He recommends, after sufficient bleeding from the wound, fomentations of Goulard-water and laudanum, then a smart dose of calomel and antimony, and two hours after a large dose of opium. If the pain still continue the whole arm is to be bathed with lukewarm Goulard-water and opium; some ammonia to be given and hot drinks allowed. He considers leeches and venesection improper.

Basedow (*c*) considers that the wounds produced by poisoning in dissection agree with Malignant Pustule.

A careful collection of the various opinions on the nature and treatment of these injuries is given by M. Leo-Wolf (*d*).

[The question of absorption of poisonous matter into wounds received in dissection, has been much disputed. But I must confess, that, after nearly twenty years constant employment in the dissecting-room, I almost entirely agree with the opinions held by Lawrence on this subject. "It seems to be very doubtful," says he, "in those cases whether anything actually venomous or virulent is introduced, or whether the results of these injuries must be said to arise from such wounds, considered merely as mechanical wounds. If these be poisonous wounds, the poison certainly follows other laws than those we observe in cases in which we are more intimately acquainted with the poison * * * If they arise from a poison, then it is one of a very uncertain, and, almost you might say, capricious kind. In the first place, in the great majority of instances of wounds received in dissection, no injurious effect is produced. There are hundreds and hundreds of such wounds always occurring without any injurious consequences. It is really only in a very small proportion out of the whole number of wounds that are received, that any prejudicial effects are produced in the human frame. We can perhaps quite as well explain the occurrence of these effects when they do take place, by a reference to the particular state of health of the individual in whom they occur, as by any particular virulent property that might be applied to the wound. Now it happened to myself, when I was employed in dissection, to cut myself hundreds of times in dissecting bodies that have died under every variety of disease, and I never

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(*a*) Cooper, Astley, Lectures on the Principles and Practice of Surgery; with additional notes and cases, by F. Tyrrell. London, 1824, vol. i. p. 19–21.

(*b*) On the Treatment of Wounds received during Dissection; in London Med. and Phys. Journal, vol. liii. p. 869. 1825.

(*c*) Ueber die Schwarze Blatter; in von Graëfe und Walther's Journal, vol. xii. p. 185.

(*d*) Diss. de morbo qui lesione; in cadaveribus disseccandis haud raro sequi solet. Heid., 1832.

experienced any ill effect but once, and then I was not in very good health. I had an inflammation of the finger, with swelling up the hand and arm, and subsequently swelling of the glands in the axilla, with suppuration. There are cases, however, in which important local effects are produced, and in which very serious and even dangerous symptoms occur. * * * We cannot point out any particular state of a dead body, nor any condition of previous disease, that will certainly give rise to any set of symptoms in these cases: indeed, we shall observe, an individual receive a prick or a cut in dissection of a certain subject, and suffer certain inconveniences from it; while others, who have dissected the same subject, suffer no injurious consequences at all from a similar injury. In the majority of instances the effects that are produced seem to be nearly such as would arise from the infliction of the wounds considered in themselves, without any reference to the state of decomposition of the dissected bodies in which they occur." (pp. 651, 2.) "There are some other cases," continues the same writer, "in which the local and general symptoms have been rather different, and it is in those particularly that the agency of poison has been regarded as the true cause." And he then mentions the case of Dr. PETT (*a*), who pricked himself at eight o'clock in the morning of the 28th of December without being aware of it, in sewing up the body of a female who had died of puerperal peritonitis. On the evening of the same day, feeling some heat and uneasiness, he carefully examined his fingers, and at the tip of one observed a blush, with a very minute opening in it. This he touched with nitrate of silver and nitric acid, without, however, causing pain; but as the uneasiness continued he again applied the nitrate of silver later in the evening, till he felt it sensibly, and then the pain became agonizing. On the morning of the 29th, after having passed a very restless night and had shiverings, the eschar was noticed as large as a split pea, and at 1, P.M., the finger had become swollen, had a livid appearance, and was very painful. An incision was then made down to the bone, which gave no pain, nor did any blood flow, and the last two joints were gangrenous: red lines extended along the fore arm to the elbow, and pain up to the axilla; complete prostration of strength; irregularity of breathing and considerable torpor came on; and, during the rest of the day, he had much heavy sleep, occasionally disturbed by severe attacks of pain: the pulse soft and between 90 and 100. The hand and arm continued swelling, the absorbents inflamed, as also the axillary glands, accompanied with an erysipelatous blush, which extended over the side of the chest, and the torpor and difficulty of breathing increased. Punctures were made, but without giving vent to any pus, and he died at 6, A.M., on the 1st of January.

The most certainly dangerous punctures, as far as my observation goes, are those which have happened in the examination of cases of peritonitis, either of the common or puerperal form; which certainly would lead to the presumption that, in such instances, there is an absorption of poison. But, on the other hand, I am sure that almost if not quite as severe symptoms have occurred when the wound has been received in examining a body recently dead and quite fresh. With regard to putrid subjects, or those just beginning to be so, my experience proves that wounds from them are almost invariably the least formidable kind. How these facts are to be explained other than by the assumption of a peculiarity in the constitution at the time of receiving the wound, I do not presume to say; but certainly, as regards the affections from peritoneal disease, there does appear to be a very strong presumption of poisonous matter having been absorbed.

In wounds received in dissecting I believe the mischief is often very considerably increased, if indeed it be not excited, by the very improper application of escharotics, either nitrate of silver, nitric acid, or caustic potash. All that I ever thought of doing for myself, or recommending to be done, was to wash the hand carefully, and then suck the wound for ten minutes or so, and afterwards to apply a poultice. If the matter did not rest there, but inflammation with swelling and great pain came on, leading to the belief of the sheath of one or other tendon, or of the palmar fascia, (according to the situation of the puncture,) or of the cellular tissue having inflamed, then free leeching was resorted to, and more or less deep incisions to relieve the tension and permit the escape of any pus that might have formed, which in an irritable constitution will happen in a few hours. As a general rule, whenever pus in these cases is found, it must be evacuated immediately, as the longer it is left the more it increases the constitutional excitement.

It not unfrequently happens after wounds received in dissection have passed through the more aggravated symptoms, that the scar remains red, angry, tender, swollen, elevated and spread, so that, that which was primarily a mere pin-hole wound becomes as large or larger than a sixpence, and is covered with a soft scaly cuticle, beneath

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(*a*) For full particulars of this case, see TRAVERS On Constitutional Irritation, p. 292–306.

which an ichorous exudation is continually produced, and has somewhat the appearance of an inflamed soft wart. This often continues for months, and resists all kinds of treatment, till change of air is made, soon after which it commonly subsides without any further assistance. Another consequence, after every other symptom has subsided and all trace of the original injury has disappeared, is, a creeping erythema, first beginning about the injured part, and then travelling about the hand and arm. I have frequently seen it run up one side of the finger to its tip, and down again to the knuckle, then pass to the next finger, up and down it and on again to the next, and having made the circuit of all the fingers, repeat its course. Positive pain in these cases there is none, but itching is plentiful and the annoyance scarcely creditable. Simple spirit wash, or camphorated spirit wash, or lead wash, or grease of any kind are alike useless. And the only remedy I have seen at all efficacious is change of air, but even this often for a long while fails of getting rid of this troublesome companion. —J. F. S.]

353. The *stings of bees and wasps* are the slightest kinds of poisoned wounds. An acrid fluid is introduced with the sting into the wound, which usually produces very severe pain, and speedily much swelling. The early application of cold water, or camphorated vinegar, averts or diminishes these symptoms. If the pain continue, bathing with warm oil, and narcotics, may be employed. If the sting be in the wound it must be withdrawn.

[The stings of bees and wasps sometimes produce very serious consequences. Dr. Gibson mentions (*a*) a lady sixty-nine years of age, who died in fifteen minutes after receiving the sting of a yellow wasp, whilst engaged in drying apples. And he also states, that "occasionally death has followed from swallowing a wasp or bee, in consequence of the gullet being wounded by the sting of the animal, while passing to the stomach. In this way a young woman in Jersey, U. S., lost her life, a bee having been enclosed in a piece of honeycomb which she swallowed. Lawrence refers (*b*) to the case "of a gentleman in France, who was walking in his garden, in his morning-gown, with his breast open. A large beehive was upset, and he ran to put it right again; the bees fixed upon him and stung him about the throat and chest; he immediately ran into the house, and the persons around him endeavoured to liberate him from the insects as soon as they could, but he said he felt himself sinking or dying. The action of the heart became very much enfeebled, the pulse sunk, the breathing interrupted, anxiety, agitation, and alarm arose, and he died very speedily, in fact in about ten minutes." (p. 622).

Scorpion Sting.—The following is the account of one of these accidents given by Dr. Mosely (*c*):—Mrs. P. at Kingston in Jamaica, in January, 1781, was stung by a scorpion in the foot, above the little toe. The part became instantly red and painful, and soon after livid. The pain increased to great severity. Some rum was applied to the wound, on which the pain immediately left the foot, and passed up to the groin with great agony. The pain still passed upwards, and diffused itself about the pit of the stomach, neck and throat, attended with tremors, cold sweats, and languors. As the pain passed the abdomen it occasioned a violent purging and fainting, which ceased on its advancing higher. I was called to her and gave her the following medicine:—℞ *sal. succin.* ℈ij. *camph.* gr. xij. *cinnab. antim.* gr. x. *conf. card. q. s. ut fiant boli sex, omni horâ sumend. cum cochl. quat. mist. seq. viz., aq. menth.* ℥vij., *elix. pareg.* ʒij., *syr. croci* ʒiv. *misce;* a few doses of which removed every symptom. She had been extremely ill for thirty-six hours." (p. 28.) Allan (*d*) says that "the wound caused by the scorpion was always followed by a violent and extensive inflammation, considerable swelling, and great pain; but I never observed any violent constitutional symptoms succeed to the local." (p. 370.) A few years ago a man stung by a scorpion was admitted into the London Hospital: some inflammation and swelling of the hand and arm ensued, with a good deal of nervous depression; but my friend Curling tells me it soon subsided and he did well. Kirby and Spence (*e*), however, say that "the sting of certain kinds common in South America, causes fevers, numbness in various parts of the body, tumours in the tongue and dimness of sight, which symptoms last from twenty-four to forty-eight hours. The only means of saving the lives of our soldiers who

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(*a*) Institutes and Practice of Surgery, vol. i. Philadelphia. 2nd Edit., 1827. 8vo.

(*b*) Lectures on Surgery.

(*c*) A Treatise on Tropical Diseases, &c., 3rd Edit. London, 1795.

(*d*) System of Pathological and Operative Surgery, vol. i.

(*e*) Introduction to Entomology, vol. i. 3rd Edition. London, 1818. 8vo.

were stung by them in Egypt was amputation. One species is said to occasion madness; and the black scorpion both of South America and Ceylon frequently inflicts a mortal wound" (p. 125.)

Our common gnat and the mosquito (*Culex pipiens*) are among those insects which, though unprovided with a special sting, yet, according to KIRBY and SPENCE, "instil into the wound, made with their mouth, a poison, the principal use of which is to render the blood more fluid and fitter for suction." (p. 113.) Every one is unfortunately too well acquainted with the smarting pain and swelling produced by the gnat, and MOSELY says of the bites of the mosquito, that they are "sometimes scratched into painful acrid ulcers, particularly in the legs." (p. 24.) Fleas and bugs are also very irritating, and the bites of the latter especially will often produce considerable swelling of an œdematous character, when they have been made on the eyelids or cheeks of delicate children.

The *harvest bug* (*Acarus autumnalis*, SHAW) annoys us considerably. It is "a hexapod so minute," say KIRBY and SPENCE, "that were it not for the uncommon brilliancy of its colour, which is the most vivid crimson that can be conceived, it would be quite invisible * * * It attacks the legs of labourers employed in the harvest, in the flesh of which it buries itself at the root of the hairs, producing intolerable itching, attended by inflammation and considerable tumours, and sometimes even occasioning fevers." (p. 105.) Of this abominable plague I had personal experience many years ago whilst in Sussex, during harvest-time. Both legs were attacked, and the itching was so intense that I could not refrain from constant clawing (scratching will not express what I mean); the irritation continued for between a week and a fortnight, and the result was many troublesome and some not shallow sores which did not become quiet and heal for many weeks.

The writers just quoted mention other *acari*, whose operations are very troublesome, and, among them, one "common in Martinique, and called there *bête rouge.* When our soldiers in camp were attacked by this animal, dangerous ulcers succeeded the symptoms just mentioned, which in several cases became so bad, that the limb affected was obliged to be taken off." * * * But the worst of all the tick tribe is the American, (*A. Americanus*, LIN.,) described by Professor KALM. This insect, which is related to the dog-tick, is found in the woods of North America, and is equally an enemy to man and beast. They are there so infinitely numerous, that, if you sit down upon the ground, or upon the trunk of a tree, or walk with naked feet or legs, they will cover you, and plunge their serrated rostrum into the bare places of the body, begin to suck your blood, going deeper and deeper till they are half buried in the flesh, though at first they occasion no uneasiness. When they have thus made good their settlement, they produce an intolerable itching, followed by acute pain and large tumours. It is now extremely difficult to extract them, the animal rather suffering itself to be pulled to pieces than let go its hold; so that the rostrum and head being left in the wound produce an inflammation and suppuration which render it deep and dangerous. These ticks are at first very small, sometimes scarcely visible, but by suction will swell themselves out till they are as big as the end of one's finger, when they often fall to the ground of themselves." (p. 106.)

Other insects become sources of annoyance, not from the irritation of any poison, but simply by burying themselves beneath the skin to deposit their eggs. Of this kind is the great West Indian plague, the chigoe (*Pulex penetrans.*) MOSELY in speaking of them says:—"Another tropical insect frequently attacks the feet and toes of new comers, and surprises them with an unusual sensation of itching. * * * They are about the size of a cheese-mite; they lance the skin imperceptibly in the soles of the feet, or about the toe-nails, and insinuate themselves, where they deposit their eggs, including their eggs and themselves in a little round vesicle, which increases to the size of a small pea, sometimes before it is noticed. It then acquires a bluish appearance, from the colour of the chigoe itself, which is in the midst of an innumerable quantity of *animalcula*, each of which is capable of creating a new disturbance, if, in taking out the bag it be broken, and any remain behind in the flesh. Some people have had great inflammations from them, and some have had their toes mortified. The negroes often let them collect and remain in their feet until their toes rot off. The common method of taking out the bag is with the point of a needle, without piercing it by separating it from the skin quite round and drawing it out; then filling up the hole, and rubbing the part with tobacco ashes." (pp. 25, 6.)]

354. The severity of the symptoms after the *bite of a viper* depends on various circumstances; for example, whether more or less fluid has been

poured from the poison bag into the wound; whether the viper was excited or not at the moment when it bit. In winter the poison is less active than in summer; but very rarely is the bite fatal. Immediately after the bite a severe burning in the wound occurs, the bitten part inflames and swells, and the inflammation spreads over the whole limb; the lymphatic vessels are red and swollen to the next glands; the glands themselves swell; high fever comes on, delirium, small pulse, vomiting, pain in the region of the heart, and often in that of the throat; not unfrequently convulsions, jaundice, anxiety of mind, fainting, also are noticed.

The best mode of destroying the poison in the wound, and for preventing its absorption is, after cutting upon it, to cauterize it with strong *liquor ammoniæ*, or with butyr of antimony; the compression of the limb above the bitten part by means of a cord, and the application of a cupping-glass (*a*). The neighbourhood of the wound is to be rubbed with oil; the part may be touched with oil in which caustic ammonia has been mixed. Fluid volatile alkalies are to be given internally, and the patient kept in bed, in order to keep up properly the accompanying perspiration.

Cupping-glasses and ligatures have only momentary effect if all of the poison be not removed from the wound (*b*). It appears from PENNOCK's observations (*c*) that the application of the cupping-glass operates partially by the pressure of its edge numbing the nerves of the part, partly by the removal of the atmospheric pressure preventing the absorption of the poison. It is therefore always necessary before removing the cupping-glass to lay the wound open. RODRIQUE (*d*) is of the same opinion, but he still advises the application of the ligature by which the absorption is also diminished.

[FONTANA did not consider that the bite of a common viper would be fatal to an adult, and observes that of a dozen cases he had known, and of fifty more he had heard of, only two terminated fatally. He could not obtain any history of one of these cases, but in the other gangrene commenced three days after the accident, although the wound had been freely cut into, almost immediately after the bite had been received, and the person died in twenty days. A case is, however, mentioned (*e*), of a woman, aged sixty-four, who died in thirty-seven hours after having been bitten on the thigh by a viper, notwithstanding the wound had been enlarged and cauterized with *liquor ammoniæ*, which was also administered internally.

An instance of death after a viper-bite occurred some years ago at St. Bartholomew's Hospital, in a young man about eighteen years of age, who was under my friend VINCENT's care. He was very weakly, had considerable pain and swelling of the arm and side bitten, followed by extensive erysipelas and sloughing; no generous diet, &c., could keep up his powers, and after several weeks he sunk. I have seen a few cases of viper-bites in spring and summer, at which periods the animal is in strong health and proportionally virulent, but I have never seen the severe symptoms above described, nor has it been necessary to employ any other than very simple treatment, the means for which may in general be immediately procured. The pain is always very severe, and swelling in the immediate neighbourhood at once commences, which spreads rapidly up the limb, without the least resemblance of inflammation, but like an œdema of long continuance, and the skin is stretched almost to bursting in the course of three or four hours. An extreme sensation of depression, bordering upon faintness, soon sets in, accompanied with frequent vomiting; but I have never seen the constitutional affection proceeding further. The wound has sometimes assumed a gangrenous appearance, but generally has been scarcely distinguishable. The treatment I have employed is exceedingly simple,—continued smearing for two or three hours of the whole limb, so far as it was swollen, with olive oil, and the administration of brandy again and again till the symptoms of depression have disappeared. The oiling is to be repeated less frequently afterwards, but sufficiently to keep the parts well soaked in oil. The pain soon subsides after the application of the oil, but the swelling and uneasiness from the dis-

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(*a*) PIORRY, Considérations physiologiques sur la Morsure d'une Vipére, traité avec succès par l'application de Ventouses; in Révue Médicale, Oct., 1826, p. 63.

(*b*) Annales des Sciences d'Observations. Paris, 1829, April, p. 123.

(*c*) American Journal of the Medical Sciences, May, 1828.

(*d*) Ibid, August, 1828.

(*e*) Annales du Cercle Médicale, vol. i. p. 44. 1820.

tension of the skin is more enduring, and does not begin to subside till eighteen or twenty-four hours have elapsed, but then both disappear gradually, and after four or five days no traces of the injury remain, excepting that the patient is a little languid. In the cases under my own care I have never applied any caustic, and in those where nitrate of silver has been applied, I do not believe it has been of any real use; for, unless a wound be very large, it will rarely penetrate much below the surface. I do not, therefore, think it useful. How oiling the part acts I do not pretend to explain; but although Dr. MEADE and the French Academy deny its efficacy, it is a fact beyond doubt that grease does very speedily relieve the pain and remove all the symptoms. Hence the vulgar practice of killing the viper, if it can be caught, and rubbing its fat over the bitten and swollen part, of which MEADE was well aware, for he says (*a*):—"Though they (the viper-catchers) keep it as a great secret, I have, however, upon strict inquiry found it out to be no other than the *Axungia viperina* presently rubbed into the wound. And to convince myself of its good effects I enraged a viper to bite a young dog in the nose: both the teeth were struck deep in; he howled bitterly, and the part began to swell. I diligently applied some of the *axungia* I had ready at hand, and he was very well the next day." (pp. 45, 6.)

The practice of applying a ligature above the wound from a venomous bite is at least as old and probably much older than CELSUS, who says:—"Igitur in primis supra vulnus id membrum deligandum est; non tamen nimium vehementer, ne torpeat."—lib. v. cap. xxvii. ASTLEY COOPER recommended this practice, and, indeed, himself had recourse to it when bitten by a viper, which recovered itself after having been frozen, as he carelessly held it in his hand, whilst lecturing. HOME also says:—"The only rational local treatment, to prevent the secondary mischief, is applying ligatures above the tumefied part, to compress the cellular membrane, and set bounds to the swelling, which only spreads in the loose parts under the skin, and scarifying freely the parts already swollen, that the effused serum may escape, and the matter be discharged as soon as it is formed.

The practice of sucking venomous bites was well known to the ancients. A people of Africa, called *Psylli*, were celebrated for their cure of serpent-bites, which they effected by applying their mouth to the wound, and sucking out the poison. The Italian *Marsi* also pretended to the same power. CELSUS observes, with regard to this practice:—"Neque herculè scientiam præcipuam habent hi, qui Psylli nominantur, sed audaciam usu ipso confirmatam. Nam venenum serpentis, ut quædam etiam venatoria venena, quibus Gallis precipuè utuntur, *non gustu, sed in vulnere nocent.* Ergo quisquis exemplum Psylli secutus, id vulnus exsuxerit, et ipse tutus erit, et tutum hominem præstabit."—lib. v. cap. xxvii. The truth of the observation, that the poison is not hurtful in the mouth but in the wound, has since been fully proved by RUSSELL. But it may be presumed from CELSUS's concluding observation, that practice was not very general even in his time, though he vouched for its safety. MEADE thought this mode of cure ought to be revived, the following remarkable case having occurred a few years before he wrote, which confirmed his opinion:—"A man was bit on one of his fingers by a rattlesnake just then brought over from Virginia. He immediately put his finger into his mouth and sucked the wound. His underlip and tongue were presently swelled to a great degree; he faltered in his speech, and in some measure lost his senses. He then drank a large quantity of oil, and warm water upon it, by which he vomited plentifully. A live pigeon was cut in two and applied to the finger. Two hours after this, the flesh about the wound was cut out, and the part burnt with a hot iron, and the arm embrocated with warm oil. He then recovered his speech and his senses. His arm continued swelled the next day; but by common applications soon grew easy, and the patient suffered no farther mischief. As the poison of this snake is more quick and deadly than any other that we know, a remedy for this will most certainly prove effectual against that of smaller vipers, and all other creatures of this kind." (pp. 40, 41). The Doctor does not think that, excepting the vomit, any of the other applications were of use, and "embrocating the arm with oil only abated the swelling;" which view of the case he held confirmed by the physicians of the Academy of Paris, who, after making experiments with oil, "pronounced it ineffectual." He, therefore, recommends that "the first thing to be done upon the bite of a viper of any kind is that the patient should immediately suck the wound if he can come at it; if he cannot, another person should do this good office for him. Whoever does it, ought (to prevent any inflammation of the lips and tongue from the heat of the poison) to wash his mouth well beforehand with warm oil, and hold some of this in the mouth while the suction is performing. After this is over, it will be proper to give a vomit. A dose of *rad. ipecac.*, encouraged in the working with oil and warm water, may be sufficient. The good effect of

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(*a*) A Mechanical Account of Poisons. London. 8vo. First Edit., 1702. Fourth Edit. 1747.

this is [*risum teneatis?*] owing to the shake, which the action of vomiting gives to the nerves, whereby the irregular *spasms*, into which their whole system might be drawn, is prevented." (pp. 42, 43.) I suspect that the sucker in the case mentioned by the Doctor not only neglected this precaution, but probably had some abrasion of the lining membrane of his mouth, or he would have escaped the swelling of his underlip and tongue.

As a modification of the sucking practice, Sir David Barry (*a*) proposed the use of the cupping-glass over the snake-bite, and made numerous experiments on brutes, from whence he inferred *first*, that neither sound nor wounded parts of the surface of a living animal can absorb when placed under a vacuum; *secondly*, that the application of the vacuum, by means of a piston cupping-glass placed over the points of contact of the absorbing surface and the poison which is in the act of being absorbed, arrests or mitigates the symptoms caused by the poison; *thirdly*, that the application of a cupping-glass for half-an-hour deprives the vessels of the part, over which it is applied, of their absorbent faculty, for an hour or two, after the removal of the glass; *fourthly*, that the pressure of the air forces into the vacuum, even through the skin, a portion of matter introduced into the cellular tissue by injection, that is, if the skin of the animal be not too dense, as in the dog. He objects to scarifications, because if beyond the cupping-glass, the contents of the divided vessels will cease to be influenced by it. But he does not object to excision, if the cupping-glass be applied previously for an hour, by which he supposes the contents of all the vessels will have acquired a retrograde direction, and, after excision, the cupping is to be again resorted to.

Meade took some pains to ascertain the nature of viper-poison. Having obtained some by irritating the animal, till it bit upon something solid, so as to void its poison, he put it under a microscope, and at first "could discover nothing but a parcel of small salts nimbly floating in the liquor; but, in a very short time, the appearance changed, and these saline particles were now shot out as it were into crystals of an incredible tenacity and sharpness, with something like knots here and there, from which they seemed to proceed, so that the whole texture did in a manner represent a spider's web, though infinitely finer and more minute." (p. 15.) On the application of chemical tests the poison did not exhibit either acid or alkaline properties. After sundry other experiments, "we resolved," says the doctor, "to end our poison enquiries by tasting the venomous liquor. Accordingly, having diluted a quantity of it with a very little warm water, several of us ventured to put some of it upon the tip of our tongues. We all agreed that it tasted very sharp and fiery, as if the tongue had been struck through with something scalding or burning. This sensation went not off in two or three hours; and one gentleman, who would not be satisfied without trying a large drop undiluted, found his tongue swelled with a little inflammation, and the soreness lasted two days. But neither his nor our boldness was attended with any ill consequence." (p. 22.)]

355. The bite of snakes in hot countries produces the same symptoms as those from the viper, but so quickly and so violent that death soon follows, especially if any considerable blood-vessel be injured. The remedies recommended in these wounds, besides the cutting out or destruction of the bitten part with the simultaneous application of the cupping-glass and ligature, are, senega root, fluid alkalies, and especially arsenic in large doses (*b*).

The poison of the more venomous snakes does not always act alike, as will be presently seen by comparing the symptoms enumerated by Dr. B. S. Barton as produced by the rattlesnake, with those resulting from the cobra de capello mentioned by Dr. Patrick Russell. But, though rarely, they are sometimes fatal either immediately, within a few hours, or by the more remotely consequent sloughing of the cellular tissue of the limb which the constitution cannot overcome. Barton (*c*) observes, that "in those cases where the poison is applied near to the orifice of an absorbing vessel, we have reason to suppose that it will be conveyed into the mass of blood with great celerity." (p. 106.) "But, unfortunately, cases sometimes occur in which this active matter is thrown immediately into a vein or artery. When this happens, the effects of the poison will be more

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(*a*) Researches on the Influence of Atmospheric Pressure upon the Blood in the Veins. London, 1826. 8vo.

(*b*) Ireland, Some Account of the Effects of Arsenic in counteracting the Poison of Serpents; in Med.-Chir. Trans., vol. ii. p. 398.

(*c*) An Account of the most Effectual Means of Preventing the Deleterious Consequences of the Bite of the *Crotalus horridus*; in Trans. of the American Philosophical Society, vol. iii. Philadelphia, 1793.

readily propagated to the remotest parts of the system." (p. 107.) And subsequently he asks, "Does not this very sudden appearance of the nausea and vomiting seem to render it probable that the poison of the rattlesnake exerts considerable effects on the nervous matter of animals." (*note*, p. 110.) That it does sometimes so act upon the nervous system cannot be doubted, for in some of the cases mentioned by Russell the bitten person died in a few minutes, and in one almost instantaneously, so that there could not have been time either for the absorption of the poison into the blood or its diffusion through the body by the blood-vessels.

The following are the symptoms given by Barton as following a rattlesnake's bite. "When the poison of the rattlesnake has actually been introduced into the general mass of blood it begins to exert its most alarming and characteristic effects. A considerable degree of nausea is a very early symptom. (*Note.* It is remarkable that a nausea, and sometimes a vomiting, is induced in many cases in a few minutes after the poison has been thrown into a muscular part, and long before it can possibly have entered the blood-vessels, through the medium of the absorbent lymphatics; or, admitting that it has been introduced directly into a blood-vessel, before this active poison can have effected in the general mass any change whatever. Does not this sudden appearance of the nausea and vomiting seem to render it probable that the poison of the rattlesnake exerts considerable effects on the nervous matter of animals?) We now discover an evident alteration in the pulse; it becomes full, strong, and greatly agitated. The whole body begins to swell: the eyes become so entirely suffused, that it is difficult to discover the smallest portion of the adnata that is not painted with blood. In many instances there is an hemorrhagy of blood from the eyes, and likewise from the nose and ears; and so great is the change induced in the mass of blood, that large quantities of it are sometimes thrown out on the surface of the body in the form of sweat; the teeth vacillate in their sockets, whilst the pain and groans of the unhappy sufferer too plainly inform us that the extinction of life is at hand. In this stage of its action, and even before it has induced the most alarming of the symptoms which I have mentioned, the powers of medicine can do little to check the rapid and violent progress of this poison." (p. 110.)

Professor Owen informs me, that in 1840 he saw in the military hospital near Plymouth, a soldier, who having in a piece of bravado put a viper's head in his mouth, was, as might have been expected, bitten in the tongue, which soon swelled so much that respiration was almost entirely prevented, and also the introduction of any medicine into the stomach by the mouth. He did not see the termination of the case, nor is he aware of the treatment; but he believes the man recovered. This is the only instance of rattlesnake-bite in this country with which I am acquainted, except the following case which came under Home's care some years since in St. George's Hospital, and is an instance of death resulting from slough of the cellular tissue of the limb (*a*).

A spare man, aged twenty-six years, in attempting to take his rule from a rattlesnake's cage, into which he had dropped it whilst attempting to irritate the animal, was bitten twice, *Oct.* 17, 1829, half past 2, P.M., receiving two wounds on the back of the first joint of the thumb, and two on the second joint of the fore finger. He went to a chemist in the neighbourhood, who, considering him in a state of intoxication, (which, however, did not appear to have been the case,) gave him a dose of jalap and applied some slight remedy to the bites. No swelling in the hand had then appeared; but it speedily commenced, and when he reached St. George's Hospital, *half-an-hour after*, the swelling had extended half way up the fore arm; the skin on the back of the hand was very tense, and the part very painful. In an hour after the swelling had reached half way up the arm, and the pain had extended into the arm-pit. The skin was cold; pulse, 100; and he complained of sickness. *Aq. ammon. pur.* ♏xx. *spir. æther. vitriol.* ♏xxx. *mist. camph.* ℥j. were given but rejected. The wounds were bathed with *aq. ammon. pur.*, and the whole limb with camphorated spirit. At 5, P.M., he took *spir. ammon. camph.* ʒij. *æther.* ♏xxx. *mist. camph.* ℥j., which was retained. An hour and a half after, his pulse having become very feeble, *æther. et aq. ammon. pur.* āā. ♏xxx. *ex aquâ* were given and repeated at the next hour. At 9, P.M., he felt greatly depressed, his skin was cold, pulse 80, and weak; the dose of both medicines was increased to fifty drops, and repeated. In rather more than an hour after, the pain had become very violent in the arm; and, though his pulse was stronger, he was attacked with fainting every fifteen minutes, but the pulse was not visibly depressed. At half-past 11 the swelling involved the whole arm up to the arm-pit; the arm was quite cold, and the surface generally unusually cold, and no pulse could be felt in any part of it. He was then perfectly collected; but, an hour and a half after, talked indistinctly.

(*a*) The Case of a Man who died in consequence of the Bite of a Rattlesnake; with an Account of the Effects produced by the Poison; in Phil. Trans. 1830, p. 75.

Oct. 18. 8, A.M. Pulse 132, and very feeble. The swelling had not extended; but there was a fulness down the side, and blood extravasated under the skin, as low as the loins, producing a mottled appearance. The arm and hand cold, painful when pressed, very tense vesications near the elbow, and under each of these a red spot in the cutis as large as a crown-piece. The general surface had become warm; but he was low and depressed; the faintings had continued recurring every quarter of an hour, and there was a tremulous motion of the limbs. The medicine had been continued during the night, but the last dose was rejected; some warm wine, however, was retained. Fomentations were applied to the arm. *Noon.* Some broth which he had taken was rejected; and, in addition to the previous symptoms, there was starting of the limbs. "The skin of the whole arm had a livid appearance, similar to what is met with in a dead body, when putrefaction has begun to take place, unlike anything which I (HOME) had ever seen in so large a portion of the living body. An obscure fluctuation was felt under the skin of the outside of the wrist and fore arm, which induced me to make a puncture with a lancet, but only a small portion of a serous fluid was discharged." The internal use of the volatile alkali was continued, to rouse the action of the stomach, not as a specific; but as neither it nor small quantities of brandy were retained, it was omitted. At 11, P.M., two grains of opium were given, and repeated every four hours. The vesications and red spots had increased in size.

Oct. 19, 3, P.M. Was drowsy, probably from the opium and brandy taken; was more depressed, and spoke only in whispers, but the faintings were less frequent. The vesications had increased, but the arm had diminished in size, and he had sensation down to the fingers. *At* 11, P.M. The pulse 130, and low. The opium was left off; a motion obtained by clyster; and he was ordered camphor mixture, wine, and brandy, as often as he would take them.

Oct. 20. Had dozed during the night; his spirits were better, and his extremities were warmer; he had taken some coffee at breakfast, but rejected fish at dinner; brandy and coffee a table-spoonful occasionally were given, as more could not be retained.

Oct. 21. Had slept at intervals during the night, and was occasionally delirious; pulse 120. The size of the arm was diminished, but the skin was extremely tender. Brandy and jelly only staid on his stomach.

Oct. 22. The right side of the back down to the loins was inflamed, painful, and had a very mottled appearance from the extravasated blood under the skin. As this evening his pulse had become full, he was ordered wine instead of brandy.

Oct. 23. The vesications had burst, and the exposed cutis was dressed with white ointment; but the arm was still very painful, though reduced in size. Porter was ordered instead of wine; and both yesterday and to-day he has had veal for dinner. A saline draught with antimonial wine was ordered in the evening.

Oct. 27. The swelling and inflammation of the arm have increased; he attempted to sit up, but the weight and pain forbade it. The arm was bathed with *spir. vin. rect. et liq. ammon. acet.* āā *part. aq.* The pulse is now very frequent, and the tongue furred.

Oct. 28. Had a rigor last night; a slough has began to separate on the inside of the arm below the axilla. Purging having come on, chalk mixture with laudanum was ordered.

Oct. 29. The purging is abated; but the pulse is 100, and feeble. A large abscess on the outside of the elbow was opened, and half a pint of reddish brown matter with some cellular sloughs discharged; but the upper part of the arm was still tense. A poultice to it; and the fore arm strapped with soap cerate. Ordered wine and porter and bark.

Oct. 30. The purging having returned. the bark was left off; chalk mixture and laudanum given, and an opiate clyster administered.

Oct. 31. The purging continued; pulse 120; and at night he had a rigor.

Nov. 1. Delirious at intervals; voice feeble; no appetite.

Nov. 2. Pulse very weak; countenance depressed; tongue brown; the stomach rejects every thing but porter; delirium last night; mortification extending more towards the axilla.

Nov. 3. The purging continues; the mortification has spread considerably; the fore finger, which had become gangrenous, was removed at the second joint. And on the following afternoon at four o'clock he died.

Autopsy sixteen hours after death.—The fang wounds were healed, but the puncture on the back of the wrist was still open. The whole of the cellular tissue of the arm was sloughy, the skin separated from the muscles, and dark coloured offensively smelling fluid between them. The other morbid appearances detailed are of no consequence.

The symptoms which follow the bite of the cobra di capello, (*Naja,*) as mentioned by

Dr. **Patrick Russell** (*a*), differ from those produced by the rattlesnake. In one case, "a Malabar woman who had been bitten in the small of the leg, after ten hours had lost her senses of seeing and feeling, and deglutition was so much impeded that hardly any thing could be got to pass into the stomach. No other parts were visibly affected by spasms; but a torpor and listlessness pervaded the whole system, and from the moment of the bite had continually increased." She recovered in the course of ten days, after dilating the wound, and dressing it with mercurial ointment, under the use of the Tanjore pill. (p. 78.) In another case, "a Dubash was bitten in the toe; a few drops of blood issued from the part, and he was immediately sensible of pain. In half-an-hour the pain had extended up to the knee; and ten minutes after up to the top of the thigh, and much more severe. He then complained of severe pain in the belly, which was tense, and much swollen. A sense of tightness spread towards the chest, and respiration became very laborious. Soon after deglutition became impeded, and the stricture in the œsophagus increased so much that nothing could be forced down his throat; he foamed at the mouth; his eyes stood staring and fixed; his pulse and respiration became hardly perceptible, and, in short, every vital motion seemed at a stand." He recovered from the immediate effects of the poison, with the use of Madeira wine and the Tanjore pills, in the course of a few hours, but was weakly for some days. (p. 79.) The following case is remarkable on account of the sloughing which ensued, as in **Home**'s case, but the man recovered. "A Gentoo man, about forty years of age, was bitten in the fleshy part between the thumb and fore-finger; he instantly felt a sharp pain in the part bitten, which soon spread on the palm and upwards on the arm. He was sensible also of sickness at the stomach, but did not vomit. In less than an hour the hand and wrist were considerably swelled, the pain extending nearer the shoulder; he was sensible of a confusion in his head, and had a strong disposition to doze. He at times showed much inquietude, without making any specific complaint; at other times he lay moaning and dozing. Towards midnight his disorder increased, startings about his throat were observed, his breathing became laborious, he could not speak articulately, and seemed not to perceive objects though his eyes were open. A poultice of herbs was applied, and a secret internal antidote administered. When seen next morning by the surgeon, his hand and arm were monstrously swollen, and the punctures were presumed to be livid, although this might have been from the stain of the poultice which could not be got off. He had recovered his senses, was free from fever, and complained only of confusion in the head, of langour, and of pain in the arm. Bark was ordered, but a few doses only were taken. The parts about the puncture mortified first; the gangrene then spread over the back and palm of the hand, and part of the wrist, laying the tendons bare, and forming an ulcer of considerable extent, which, however, healed favourably under the usual treatment. He recovered his health in eight or ten days; but it was several months before he recovered the use of his hand." (p. 82.)

Russell also mentions three fatal cases of snake-bites, but without stationing what kind of snake. The first was that of "a Havildar, who was bitten at one o'clock in the morning, in the little toe of the right foot. He was not at the moment sensible of much more pain than that occasioned by the bite of a large ant, and lay down to sleep. At day-light he was found almost stiff, yet still retained the power of speech, and declared he should inevitably die in consequence of the bite. He complained very little of pain, but seemed to suffer a general stupor; he had totally lost his sight, and expired before seven in the morning. * * * The second was a Gentoo boy, who, thrusting his hand into a hole in the wall, was bitten in the hand. He exclaimed loudly, and his master, running to know what had happened, found the boy hardly able to give an account of what had befallen him, and in not more than ten minutes after crying out, he expired. * * * The third was a very stout Arab porter, who was bitten by a small snake, and expired almost instantaneously. The snake was that called by the Portuguese cobra de morte, from six to nine inches long, as thick as a tobacco-pipe; the head black, with white marks, bearing some resemblance to a skull and two cross bones; the body alternately black and white, in joints, the whole length." The first case, which expired within six hours after the bite, **Russell** observes, "agreed nearly, as to time, with the *few* fatal accidents he heard of while in India." (p. 78–81.)

Barton, speaking of the mode in which rattlesnake bites were treated in Pennsylvania in his time, says:—"In general the first thing that was attended to, after a person had been bitten by the rattlesnake, was to throw a tight ligature above the part into which the poison had been introduced; at least this was the practice wherever the situation of the wounded part admitted of such an application. The wound was next scarified, and

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(*a*) Account of Indian Serpents collected on the Coromandel Coast, &c., together with Experiments and Remarks on their several Poisons. London, 1796. Fol.

a mixture of salt and gunpowder, sometimes either of these articles separately, was laid upon the part. Over the whole was applied a piece of the bark of the white walnut. At the same time some one, frequently more than one, of the vegetables which were mentioned to me, were given internally, either in decoction or infusion, along with large quantities of milk." (p. 102.)

The treatment of these cases in India, during **Russell**'s time, was the celebrated Tanjore pill, of which the following is the composition, as given by **Duffin**:—White arsenic, roots of vellinavi, kernels of nervalam, pepper, quicksilver, of each an equal part; the quicksilver is to be rubbed with the juice of the wild cotton (*Asclepias gigantea*) till the globules become invisible. The arsenic being first levigated, and the other ingredients reduced to a powder, are then added, and the whole is beaten up together, with the juice of the wild cotton, to a consistence fit to be divided into pills. If a person is bit by a cobra de capello, mix one of the pills with a little warm water and give it to the patient. After waiting a quarter of an hour, should the symptoms of infection increase, give two pills more; should these not sufficiently counteract the poison, another pill must be given an hour after. This is generally found sufficient. The wound should be dilated, and the warm liver of a fowl applied to the part. * * * For the bite of less poisonous snakes, one pill every morning for three days is sufficient. The patient ought to keep a regimen for six days, eating only congee (rice water) and rice, or milk and rice. He should abstain from salt, and his drink may be warm water. Sleep is to be prevented for the first twenty-four hours. The pills generally occasion a nausea and purging, but seldom in a violent degree." (pp. 74, 5.)

The favourable report on the use of the Tanjore pill, of which arsenic is the principal remedy, led **Ireland** (*a*) to employ **Fowler**'s solution, which contains half a grain of arsenic in a drachm of the solution, in cases which had been bitten by the great lance-headed viper of Martinique, (*Trigonocephalus lanceolatus*, **Oppel.**) Persons previously bitten had died, without using this medicine, between six and twelve hours after receiving the wound. This practice was successful in four or five cases.

Russell says, that "the poisons of all the venomous serpents he has examined are in colour and consistence very much alike at the moment of emission through the fangs. They differ somewhat in colour from each other, but not more than the poison of each individual is found occasionally to differ from itself. The poison is somewhat mucilaginous when first emitted, but becomes quickly more so when exposed to the air; while its colour, from pale yellowish white, changes to yellowish; and when dry, it resembles a yellow flaky resin. This resin, when long kept, grows much darker in colour, and is not easily soluble; but when recent or in the intermediate degrees of hardening, it mixes readily enough with water or with spirits." **Russell** applied less than one drop of the poison of the cobra de capello (*Naja tripudians*, **Merr.**) to his tongue, but after remaining ten minutes, it was insipid and inert like pure water. He was neither sensible at first of any saline taste, nor, though strictly attentive, could he perceive any subsequent effect whatever on the tongue. This experiment was repeated more than once, at different times, invariably with the same result. The poison of the katuka retula poda (*Vipera elegans*, **Merr.**) was tried, with precisely the same success. Of a quantity which was emitted through the fangs, he rubbed almost two drops, perfectly recent, on his tongue and palate; but was neither sensible of pungency, nor of any consequence from it, more than from the poison of the cobra de capello." The recent poison of snakes applied to the eyes of chickens caused no visible irritation, nor was it followed by inflammation. The recent poisons of the cobra de capello and katuka rekula poda, under the usual trials, gave no indication of possessing either an acid or alkaline quality." (pp. 86, 7.)

Barton mentions the following very curious observation, which is well worthy remembrance:—"It often happens that the poison of the rattlesnake, like that of the mad dog, being merely thrown into muscular, tendinous, ligamentous, or cellular parts, is deposited there some time without being absorbed into the mass of blood. In these cases the success of the plan which I have described will, probably, be very great. Whatever preference may be given to the use of the knife or of the caustic over that of scarification, the application of the blister, &c., I think there can be very little doubt of the propriety of employing the ligature. I am convinced, indeed, that on the use of this simple application the success of our cure, or to speak more properly, of our prevention, will in a great measure depend." (p. 107.)

Upon the bite of the rattlesnake, compare Révue Médicale, May, 1827, p. 298-321.

356. The *bite of a rabid beast*, specially of a dog, wolf, fox, cat, sometimes even of some others, poison the wound with a peculiar contagion,

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(*a*) Above quoted.

which, by its operation on the organism, produces *hydrophobia*, Lat.; *die Wasserscheue*, Germ.; *Hydrophobie*, Fr.; and dog-madness (*Rabies canina*, Lat.; *die Wuth*, Germ,; *la Rage*, Fr.)

From numerous and careful observations, it cannot be doubted that the bite of beasts much excited, or when disturbed during copulation, may produce canine madness.

[Neither ourselves nor the French have any vernacular title for this dreadful disease in the human subject, both therefore use the Greek compound, the French, however, giving it their national terminal; whilst the Germans have translated it. On the other hand, as regards the disease in the dog, there is a special title for it both in German and French; but we have none, and therefore indiscriminately apply the term *hydrophobia* to the disease in the dog, of which, as will be presently shown, neither the dread of water, nor incapability of swallowing it are to be properly considered as symptoms, whilst in man they are the most marked and characteristic. The Greeks had a special term for dog-madness, λύσσα or λύττα, which is used by Homer, in the 9th book, 239th line of the Iliad; and Dr. Good has, in his Nosology, proposed the reintroduction of this title, calling the disease in the human subject *Entasia lyssa*. As, however, the disease is well known and understood by the term in common acceptation, it is better to leave it alone, than to produce confusion by idle pedantry.—J. F. S.]

357. Dog-madness develops itself, either of it own accord, (spontaneous madness,) or from the transference of the poison. A high degree of heat, sudden changes of heat and cold, bad food, want of water, and unsatisfied sexual desires, are assumed as causes of the spontaneous development of this madness. The spontaneous occurrence of hydrophobia in man is denied by many, as the principal symptom, to wit, the fear of water, belongs also to several other diseases. Some observations have, however, put the possibility of the spontaneous development of canine madness in man beyond doubt (*a*).

Ziegler (*b*) fixes the origin of madness in the want of the instinctive degree of nourishment from blood and flesh, and therefore call the disease *Blut-durst* (Bloodthirstiness) or *Fleischgier* (Flesh-craving.)

358. The signs of incipient madness in the dog are generally very doubtful, and are the more to be noticed, as numerous and careful observations have proved that the dread of water is by no means a decided sign of madness in the dog, as generally stated (*c*). According to Hertwig's (*d*) frequent observations, the most important symptoms of the *raving madness* in dogs are, change of their usual manner, uneasiness, and prevailing disposition to be continually changing and running away from their place of residence and bed (1); great disposition to lick cold substances; loss of appetite, especially for firm solid food, (some few dogs, however, make an exception to this, taking from time to time some mouthfuls of better food,) and great disposition to use those things which cannot assist in their nourishment, as wood, leather, straw, wool, and so on; they lick up not only their own and other dogs' urine, but sometimes also eat their own dung. Obstinate costiveness, disposition to bite, especially when they are excited by anger, or if the dog be of a biting and passionate temper, with many snaps in the air, as if they would catch flies or other insects (2). And, most especially, a peculiar change in the voice and in the kind of bark, the former is harsh, hoarse, peevish, and uneasy-sounding, and the bark is always accompanied with a short peculiar howl (3). In no dog does consciousness cease till shortly before death. All mad dogs can look at, lick up, and drink water

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(*a*) Mangor; in Act. Soc. Reg. Hafn., vol. ii. obs. xxxii. p. 408. New York Medical Repository of Original Essays, by Mitchell, Pascalis, and Akerly, vol. v.

(*b*) Salzb. Med. Chir. Zeit., 1821, vol. iii. p. 190.

(*c*) Rust, *loc. cit.*, p. 328.

(*d*) In Hufeland's Journal, supplementary volume, 1828.—Beiträge zur näberen Kenntniss der Wuthkrankheit oder Tollheit der Hunde. Berlin, 1829.

and other fluids (4); generally they do not exhibit any increased disposition to sexual congress (5). Their external appearance at the very beginning of the disease is little or not at all changed; about the second or third day the eyes usually become reddened, and in most instances are occasionally closed for a few seconds; at the same time the skin on the forehead and above the eyes is drawn into little folds or wrinkles, in consequence of which the animal has a sleepy, surly, fretful appearance. Subsequently the eyes become dull and languid, but never fiery and lively, as at first; most have a rough, rugged appearance, and all in a short time become remarkably wasted. The mouth is in most cases rather dry than moist, and therefore generally without foam or spittle; but when the pharynx is decidedly affected, and the descent of the spittle probably hindered by its swelling, then is there an exception (6). So long as the dog has power, and so long as it is not pursued, it carries its tail as usual, wagging it cheerfully, as it may fancy; but as weakness comes on the tail hangs down loosely, though never more drawn beneath the body than usual. The gait is not altered at the beginning of the disease; they do not proceed, as commonly believed, only straight forward and in the same course, but if undisturbed run about in various directions and wanderings, trot very actively along the road, and only when a paroxysm seizes them spring aside, in order to bite (7). Many dogs, however, which run away in a bewildered state, and the greater number at a later period of the disease, when they have become confused, run straight forward in one direction, till they drop down worn out, or are driven to change their course from some accidental circumstance.

In *dumb madness* the animal also changes its manner, becomes less lively and watchful, more quiet, restful, and melancholy; the lower jaw drops, as if paralysed; the spittle flows down to the ground, and everything, even fluid, which the animal wishes to swallow, drops from its mouth (8); it can, therefore, bite but little, as the inclination to bite, to run, and even to restlessness, is diminished. All the other symptoms resemble those of raving madness. The course of the disease is in both forms very various and entirely indefinite. In all cases it runs on to death, and generally by gradual, but daily, visible wasting of the living powers, in from six to eight days after the first attack; sometimes death occurs earlier, and the animal dies suddenly, as if from apoplexy (9).

[The following important additions are from YOUATT's recent and very excellent work, *The Dog*:—

(1) "The early symptoms of rabies in the dog are occasionally very obscure. In the greater number of cases, these are sullenness, fidgettiness, and continual shifting of posture. Where I have had opportunity, I have generally found these circumstances in regular succession. For several consecutive hours, perhaps, he retreats to his basket or his bed. He shows no disposition to bite, and he answers the call upon him laggardly. He is curled up, and his face is buried between his paws and his breast. At length he begins to be fidgetty; he searches out new resting-places, but he very soon changes them for others. He takes again to his own bed, but he is continually shifting his posture. He begins to gaze strangely about him as he lies on his bed. His countenance is clouded and suspicious. He comes to one and another of the family, and he fixes on them a steadfast gaze, as if he would read their very thoughts. 'I feel strangely ill,' he seems to say, 'have you any thing to do with it? or you? or you?' Has not a dog mind enough for this? If we have observed a rabid dog at the commencement of the disease, we have seen this to the very life. * * * A peculiar delirium is an early symptom, and one that will never deceive. A young man had been bitten by one of his dogs, I was requested to meet a medical gentleman on the subject. I was a little behind my time. As I entered the room I found the dog eagerly devouring a pan of sopped bread. 'There is no

madness here,' said the gentlemen. He had scarcely spoke, when in a moment the dog quitted the sop, and with a furious bark sprung against the wall, as if he would seize some imaginary object that he fancied was there. 'Did you see that?' was my reply; 'What do you think of it?' 'I see nothing in it,' was his retort; 'the dog heard some noise on the other side of the wall.' At my serious urging, however, he consented to excise the part. I procured a poor worthless cur, and got him bitten by this dog, and carried the disease from this dog to the third victim. They all became rabid the one after the other, and there my experiment ended. * * * I have again and again seen the rabid dog start up after a momentary quietude, with unmingled ferocity depicted on his countenance, and plunge with a savage howl to the end of his chain. At other times, he would stop and watch the nails in the partition of the stable in which he was confined, and fancying them to move, he would dart at them, and occasionally sadly bruise and injure himself, from being no longer able to measure the distance of the object." From this state, however, "one word recalls him in a moment. Dispersed by the magic influence of his master's voice, every object of terror disappears, and he crawls towards him with the same peculiar expression of attachment that used to characterise him. Then comes a moment's pause—a moment of actual vacuity; the eye slowly closes, the head droops, and he seems as if his fore feet were giving way and he would fall; but he springs up again, every object of terror once more surrounds him, he gazes wildly around, he snaps, he barks, and he rushes to the extent of his chain prepared to meet his imaginary foe." (pp. 131, 2.)

(2) "It is not every dog that, in the most aggravated state of the disease, shows a disposition to bite;" and mentions the case of a Newfoundland dog, the details of which are of the deepest interest. "On the other hand," he says, "there are rabid dogs whose ferocity knows no bounds. If they are threatened with a stick, they fly at, and seize it, and furiously shake it. They are incessantly employed in darting to the end of their chain, and attempting to crush it with their teeth, and tearing to pieces their kennel, or the wood work that is within their reach. They are regardless of pain. The canine teeth, the incisor teeth are torn away; yet, unwearied and insensible to suffering, they continue their efforts to escape. A dog was chained near a kitchen-fire. He was incessant in his endeavours to escape, and when he found that he could not effect it, he seized, in his impotent rage, the burning coals as they fell, and crushed them with his teeth. If by chance a dog in this state effects his escape, he wanders over the country bent on destruction. He attacks both the quadruped and the biped. He seeks the village street or the more crowded one of the town, and he suffers no dog to escape him. The horse is his frequent prey, and the human being is not always safe from his attack." (p. 140.)

(3) "In almost every case in which the dog utters any sound during the disease, there is a manifest change of voice. In the dog labouring under ferocious madness it is perfectly characteristic. There is no other sound that it resembles. The animal is generally standing, or occasionally sitting, when the singular sound is heard. The muzzle is always elevated. The commencement is that of a perfect bark ending abruptly and very singularly, in a howl a fifth, sixth, or eighth higher than at the commencement. Dogs are often enough heard howling, but in this case it is the perfect bark and the perfect howl rapidly succeeding to the bark.

"Every sound uttered by the rabid dog is more or less changed. The huntsman, who knows the voice of every dog in his pack, occasionally hears a strange challenge. He immediately finds out that dog, and puts him as quickly as possible under confinement. Two or three days may pass over, and there is not another suspicious circumstance about the animal; still he keeps him under quarantine, for long experience has taught him to listen to that warning. At length the disease is manifest in its most fearful form.

"There is another partial change of voice to which the ear of the practitioner will by degrees become habituated, and which will indicate a change in the state of the animal quite as dangerous as the dismal howl; I mean when there is a hoarse inward bark with a slight but characteristic elevation of the tone. In other cases, after two or three distinct barks will come the peculiar one mingled with the howl. Both of them will terminate fatally, and in both of them the rabid howl cannot possibly be mistaken." (p. 138.)

(4) The dog not only "can look at, lick up, and drink water and other fluids," as here described, but Youatt says, has "an insatiable thirst," resulting from the altered character and diminished quantity of saliva presently noticed:—"The dog that still has full power over the muscles of his jaws continues to lap. He knows not when to cease, while the poor fellow labouring under the dumb madness, presently to be described, and whose jaw and tongue are paralysed, plunges his muzzle into the water-dish to his very eyes, in order that he may get one drop of water into the back part of his mouth to

moisten and to cool his dry and parched fauces. Hence, instead of this disease being always characterised by the dread of water in the dog, it is marked by a thirst often perfectly unquenchable." (p. 136.)

(5) "Some very important observations may be drawn from the appearance and character of the urine. The dog, and at particular times when he is more than usually salacious, may, and does diligently search the urining places; he may even, at those periods, be seen to lick the spot which another has just wetted; but if a peculiar eagerness accompanies this strange employment, if, in the parlour, which is rarely disgraced by this evacuation, every corner is perseveringly examined and licked with unwearied and unceasing industry, that dog cannot be too carefully watched, there is great danger about him; he may, without any other symptom, be pronounced to be decidedly rabid I never knew a single mistake about this." (p. 135.)

(6) This observation is corroborated by YOUATT:—"Much has been said of the profuse discharge of saliva from the mouth of the rabid dog. It is an undoubted fact that in this disease, all the glands concerned in the secretion of saliva, become increased in bulk and vascularity. The sublingual glands wear an evident character of inflammation; but it never equals the increased discharge that accompanies epilepsy, or nausea. The frothy spume at the corners of the mouth, is not for a moment to be compared with that which is evident enough in both of these affections. It is a symptom of short duration, and seldom lasts longer than twelve hours. The stories that are told of the mad dog covered with froth, are altogether fabulous. * * * The increased secretion of saliva soon passes away. It lessens in quantity, it becomes thicker, viscid, adhesive, and glutinous. It clings to the corners of the mouth, and probably more annoyingly so to the membrane of the fauces. * * * The dog furiously attempts to detach it with his paws. It is an early symptom in the dog, and it can scarcely be mistaken in him. When he is fighting with his paws at the corners of his mouth, let no one suppose that a bone is sticking between the poor fellow's teeth; nor should any useless nor dangerous effort be made to relieve him. If all this uneasiness arose from a bone in the mouth, the mouth would continue permanently open instead of closing when the animal for a moment discontinues his efforts. If after a while he loses his balance and tumbles over, there can be no longer any mistake. It is the saliva becoming more and more glutinous, irritating the fauces and threatening suffocation." (pp. 135, 36.)

(7) "In the great majority of cases of furious madness, and in almost every case of dumb madness, there is evident affection of the lumbar portion of the spinal cord. There is a staggering gait, not indicative of general weakness, but referable to the hind quarters alone, and indicating an affection of the lumbar motor nerves. In a few cases it approaches more to a general paralytic affection." (p. 139.)

(8) "In an early period of the disease in some dogs, and in others when the strength of the animal is nearly worn away, a peculiar paralysis of the muscles of the tongue and jaws is seen. The mouth is partially open, and the tongue protruding. In some cases the dog is able to close his mouth by a sudden and violent effort, and is as ferocious and as dangerous as one the muscles of whose face are unaffected. At other times the palsy is complete, and the animal is unable to close his mouth or retract his tongue. These latter cases, however, are rare. A dog must not be immediately condemned because he has this open mouth and fixed jaw. Bones constitute a frequent and a considerable portion of the food of dogs. In the eagerness with which these bones are crushed, spicula or large pieces of them become wedged between the molar teeth, and form an insuperable obstacle to the closing of the teeth. The tongue partially protrudes. There is a constant discharge of saliva from the mouth, far greater than when the true paralysis exists. The dog is continually fighting at the corners of his mouth, and the countenance is expressive of intense anxiety, although not of the same irritable character as in rabies." (p. 141.)

(9) "Absence of pain in the bitten part is an almost invariable accompaniment of rabies. I have known a dog set to work, and gnaw and tear the flesh completely away from his legs and feet. At other times the penis is perfectly demolished from the very base. ELLIS in his 'Shepherd's Sure Guide,' asserts, that, however severely a mad dog is beaten, a cry is never forced from him. I am certain of the truth of this, for I have again and again failed in extracting that cry. ELLIS tells that at the kennel at Goddesden, some of the grooms heated a poker red hot, and holding it near the mad hound's mouth, he most greedily seized it, and kept it until the mouth was most dreadfully burned." (p. 139.)

YOUATT makes a most important observation in regard to the diagnosis, between the pain in the ear in canker and hydrophobia:—"The dog appears to suffer a great deal of pain in the ear in common canker. He will be almost incessantly stratching it, crying piteously while thus employed. The ear is, oftener than any other part, bitten by the rabid dog, and when a wound in the ear, inflicted by a rabid dog, begins to become painful, the agony appears to be of the intensest kind. The dog rubs his ear against every projecting body, he scratches it might and main, and tumbles over and over while he is thus employed. The young practitioner should be on his guard there. Is this dreadful itching a thing of yesterday, or, has the dog been subject to canker increasing for a considerable period? Canker both internal and external is a disease of slow growth, and must have been long neglected before it will torment the patient in the manner that I have described. The question as to the length of time that an animal has thus suffered will usually be a sufficient guide. The mode in which he expresses his torture will serve as another direction. He will often scratch violently enough when he has canker, but he will not roll over and over like a football except he is rabid. If there is very considerable inflammation of the lining membrane of the ear, and engorgement and ulceration of it, this is the effect of canker; but if there is only a slight redness of the membrane, or no redness at all, and yet the dog is incessantly and violently scratching himself, it is too likely that rabies is at hand." (pp. 133, 4.)

"In the dog I have never seen a case in which plain and palpable rabies occurred in less than fourteen days after the bite. The average time I should calculate at five or six weeks. In three months I should consider the animal as tolerably safe. I am, however, relating my own experience, and have known but two instances in which the period much exceeded three months. In one of these five months elapsed, and the other did not become affected until after the expiration of the seventh month. * * * The duration of the disease is different in different animals. In man it has run its course in twenty-four hours, and rarely exceeds seventy-two. In the horse from three to four days; in the sheep and ox from five to seven; and in the dog from four to six." (p. 144.)]

359. The *spittle* (but according to TROLLIET, who found the salivary glands unchanged, the *mucus* secreted from the inflamed mucous membrane of the bronchi) is the vehicle of the mad poison, which has been proved beyond all doubt by HERTWIG's experiments. This poison is of a definite character, can impregnate various substances, and retains its activity for a long while. It need not be applied directly to an open wound to manifest its effects; it may be taken up on parts which have a very thin epidermis, even without a wound. The poison seems to remain entirely inactive when applied to the uninjured mucous membrane of the digestive organs. The contagion is also held in the blood of the mad beast, as proved by HERTWIG's experiments with inoculation. Every bite of a mad beast does not produce madness; perhaps a peculiar idiosyncrasy is necessary; but the bite may be also where, the part being covered with clothes, the spittle is retained in them, and the wound is not poisoned. In beasts which have become mad from contagion, the contagion is developed, and can again propagate the disease. In reference to grass-feeding beasts, the experiments have a different result. The propagation of madness from the contagion of man to beasts, and especially to dogs, is proved by experiments, but no case is known in which it has been propagated from one man to another.

[*Appearances on dissection.*—As these are most important in enabling us to determine the actual nature of the disease with which the dog is affected, and consequently to decide upon the safety or danger of the person bitten, I have thought it desirable to give YOUATT's observations on this subject.

"In *dumb* madness," says he, "the unfailing accompaniment is, to a greater or less degree, paralysis of the muscles of the lower jaw, and the tongue is discoloured and swollen, and hanging from the mouth; more blood than usual also is deposited in the anterior and inferior portion of it. Its colour varies from a dark red to a dingy purple, or almost black. In ferocious madness it is usually torn and bruised, or it is discoloured by the dirt and filth with which it has been brought into contact, and, not unfrequently, its anterior portion is coated with some disgusting matter. The papillæ, or small projections on the back of the tongue, are elongated and widened, and their mucous covering evidently reddened. The orifices of the glands of the tongue are frequently enlarged, particularly as they run their course along the frænum of the tongue. The fauces, situated at the posterior part of the mouth, generally exhibit traces of inflammation. They appear in the majority of cases of ferocious madness, and they are never deficient after dumb madness. They are usually most intense either towards the palatine arch or the larynx. Sometimes an inflammatory character is diffused through its whole extent, but occasionally it is more or less intense towards one or both of the terminations of the fauces, while the intermediate portion retains nearly its healthy hue. There is one circumstance of not unfrequent occurrence, which will at once decide the case—the presence of indigestible matter, probably small in quantity, in the back part of the mouth. This speaks volumes as to the depraved appetite of the patient, and the loss of power in the muscles of the pharynx. Little will depend on the tonsils of the throat. They occasionally enlarge to more than double their usual size; but this is more in quiet than in ferocious madness. The insatiable thirst of the rabid dog is perhaps connected with this condition of them. The epiglottis should be very carefully observed. It is more or less injected in every case of rabies. Numerous vessels increase in size and multiply round its edge, and there is considerable injection and thickening. Inflammation of the edges of the glottis, and particularly of the membrane which covers its margin, is often seen, and accounts for the harsh guttural breathing which frequently accompanies dumb madness. The inflammatory blush of the larynx, though often existing in a very slight degree, deserves considerable attention. The appearances in the trachea are very uncertain. There is occasionally the greatest intensity of inflammation through the whole of it; at other times there is not the slightest appearance of it. There is the same uncertainty with regard to the bronchial tubes and the lungs; but there is no characteristic symptom or lesion in the lungs. Great stress has been laid on the appearance of the heart; but, generally speaking, in nine cases out of ten, the heart of the rabid dog will exhibit no other symptoms of disease than an increased yet variable deepness of colour in the lining membrane of the ventricles. No dependence can be placed on any of the appearances of the œsophagus; and, when they are at the worst, the inflammation occupies only a portion of that tube. With regard to the interior of the stomach, if the dog has been dead only a few hours the true inflammatory blush will remain. If four-and-twenty hours have elapsed, the bright red colour will have changed to a darker red, or a violet or a brownish hue. In a few hours after this, a process of corrosion will generally commence, and the mucous membrane will be softened and rendered thinner, and, to a certain extent, eaten through. The examiner, however, must not attribute that to disease which is the natural process of the cessation of life. Much attention should be paid to the appearance of the stomach and its contents. If it contains a strange mingled mass of hair, and hay, and straw, and horse-dung, and earth, or portions of the bed on which the dog had lain, we should seldom err if we affirmed that he died rabid; for it is only under the influence of the depraved appetite of rabies that such substances are devoured. It is not the presence of every kind of extraneous substance that will be satisfactory: pieces of coal, or wood, or even the filthiest matter, will not justify us in pronouncing the animal to be rabid; it is that peculiarly mingled mass of straw, and hair, and filth of various kinds, that must indicate the existence of rabies. When there are no solid indigesta, but a fluid composed principally of vitiated bile or extravasated blood, there will be a strong indication of the presence of rabies. When, also, there are in the duodenum and jejunum small portions of indigesta, the detection of the least quantity will be decisive. The remainder has been ejected by vomit; and inquiry should be made of the nature of the matter that has been discharged. The inflammation of rabies is of a peculiar character in the stomach. It is generally confined to the summits of the folds of the stomach, or it is most intense there. On the summits of the rugæ there are effusions of bloody matter, or spots of ecchymosis, presenting an appearance almost like crushed black currants. There may be only a few of them; but they are indications of the evil that has been effected. From appearances that present themselves in the intestines, the bladder, the blood-vessels, or the brain, no conclusion can be drawn; they are simply indications of inflammation." (p. 141–43.)

The following observation of YOUATT's cannot be too constantly inculcated in all persons fond of dogs, nor too carefully remembered by practitioners in making their inquiries, and coming to conclusions in cases where there is the slightest suspicion of hydrophobia. "In the early stages of rabies," says he, "the attachment of the dog towards his owner seems to be rapidly increased, and the expression of that feeling. He is employed, almost without ceasing, licking the hands or face, or any part he can get at. Females, and men too, are occasionally apt to permit the dog, when in health, to indulge this filthy and very dangerous habit with regard to them. The virus, generated under the influence of rabies, is occasionally deposited on a wounded or abraded surface, and in process of time produces a similar disease in the person that has been so inoculated by it. Therefore it is that the surgeon so anxiously inquires of the person that has been bitten, and of all those to whom the dog has had access, 'Has he been accustomed to lick you? have you any sore places about you that can by possibility have been licked by him?' If there are, the person is in fully as much danger as if he had been bitten, and it is quite as necessary to destroy the part with which the virus may have come in contact." (p. 134.) "The Hon. Mrs. **Duff**," says **Lawrence**, "had a French poodle, of which she was very fond, and which she was in the habit of allowing to lick her face. She had a small pimple on her chin, of which she had rubbed off the top, and, allowing the dog to indulge in his usual caresses, it licked this pimple, of which the surface was exposed, and thus she acquired hydrophobia, of which disease she died." (p. 619.)

With regard to the communication of hydrophobia from one human being to another, or from man to beasts, **Lawrence** observes, "numerous experiments of this kind have been made on animals, that is, the saliva of a human being, labouring under hydrophobia, has been inserted into the recent wounds of various animals; but these experiments have all failed, except in one instance, and that is mentioned by **Magendie** and **Breschet**. They took the saliva of a patient, labouring under hydrophobia in the Hôtel Dieu, and applied it to the recent wounds of two dogs, on the 27th of June. On the 26th of July one of the two dogs thus inoculated went mad, and that dog bit two others, one of which died rabid on the 26th of August; so that if this experiment be correct, and the high reputation of those who are said to have made it, leads us to place credit on the statement, we must, I suppose, admit that the saliva of the human subject has the power of communicating the disease This, however, is the only instance or fact that I know of, which at all tends to establish the point," (p. 618.)]

360. The time of the outbreak of madness after the bite is very various, according to the constitution of the person bitten, the place of the wound, the time of the year, and the various corporal and mental influences. Often from seven to fourteen, usually from twenty to forty days elapse, sometimes several months, or even still longer, before the madness breaks out. Frequently the wound is still open, but in most cases it has scarred, as it generally heals quickly, without any particular symptom.

[Very incredible statements have been made as to the interval between the reception of the bite and the appearance of the disease. These appear to have principally originated from hearsay evidence, and been brought forward by the writers of the middle ages. **Galen** says that he "knew one case, in which after the lapse of a year the person was attacked with the disease called *hydrophobia* (*a*)." **Meade** says he "remembered one after eleven months." (p. 131.) And he was informed on undoubted authority of "a gentlewoman in Yorkshire, of the age of thirty-five years, who was bit by a mad dog in the forefinger; about a month after she had a pain in that part, which shot up to the shoulder, and was thought to be rheumatic. This pain returned every month, just a day before the new moon, lasting generally three days. After fifteen months she fell into the hydrophobia, and died the third day. Her friends then recollected the bite to have happened so long before." (p. 152.) The melancholy death of the Duke of **Richmond**, in Canada in 1819, was attributed by his Grace to having had a cut on his chin, made in shaving, licked by a dog five years previous to the appearance of the disease. But it is much more probable that he was infected by a tame fox, which bit him through the thumb six or seven weeks prior to his death. **Hale Thomson** (*b*) mentions the case of a boy, aged seventeen years, who died of hydrophobia seven years after having been bitten. "He had been in prison twenty-five months, and had never been exposed during that period to the bite of any animal; but he stated that he had been severely bitten by a dog seven years ago, and a scar remained on the right hip from that cause. During the twenty-five months of his confinement he had always appeared sullen, gloomy, and reserved, and was never known to look the person in the face to whom he spoke. He had not complained of illness until three days previous to his death, when he became debilitated, and was removed into the infirmary of the prison. At first the case appeared to be that of a common cold, but symptoms were rapidly developed of the most alarming character, not unlike those of spasmodic cholera. The right hip, on which the bite had been inflicted, became excessively painful, and shooting spasmodic twitches pervaded the whole leg, the boy constantly imploring that the most violent frictions should be applied. Sixteen hours

(*a*) Εις το Ιπποκρατους προρρητικων βιβλ. α. Υπομνημα β.

(*b*) Lancet, vol. i. 1837-38.

previous to dissolution, the most decided symptoms of hydrophobia were manifested, and continued with short intermission, until convulsive delirium closed his life." (p. 675.)

Dr. **Bardsley** (*a*) relates the case of a weaver aged thirty-six years, who was brought to the Manchester Lunatic Asylum with an attack of hydrophobia, of which he died at half-past four on Saturday afternoon, the disease having made its first appearance during the Wednesday night previous; and, upon finding himself, when thirsty, unable to swallow balm tea, from a sense of pain and tightness about his throat, he was struck with the remembrance of having been bitten on the back of the leg, twelve years before, by a large dog apparently mad, which was flying from the pursuit of numerous persons. He had taken the Ormskirk medicine and the wound had healed kindly; he had never suffered any pain nor complained of the slightest uneasiness in that or the neigbouring parts, since the wound healed. Nor at the period of attack of the disease was any alteration in the colour of the skin perceptible.

It must, however, be observed, that **Bardsley** thinks the case just mentioned as one of the instances which he has noticed which "do most unequivocally exhibit the pathognomonic symptoms of *rabies canina*. * * * They who, therefore, deny that a train of symptoms, exactly corresponding to those of *rabies canina*, can arise in the human subject without the intervention of the canine poison, must attribute **Lindsay's** disorder (the case above) to the injury he sustained *twelve years ago*, from a dog supposed to have been mad. But this opinion is not confirmed by other facts of a similar kind. * * * "I am happy indeed to learn," adds he, "that several eminent practitioners have coincided with me in the belief of **Lindsay's** disorder having had no connexion whatever with the bite of a supposed mad dog." (pp. 304, 305.) He thinks his opinion is supported by a case of Dr. M. **Lister's**, in which the patient's symptoms did not come on till six weeks after the bite, and he quotes the opinions of Drs. **Darwin**, **Haygarth**, and R. **Pearson**, who entertained the same views as himself. **Lister's** case, however, really affords him no help; for, as **Elliotson** (*b*) observes, "the average time is from six weeks to three months;" and, in a case of his own, the disease did not set in till three or four months after the bite. (p. 290.) That cases do occur which simulate hydrophobia, and in which there is incapability of swallowing fluids, will be presently shown; but that these, when carefully looked into, will be distinguishable from this dreadful disease, cannot be doubted. By some physicians, the actual existence of any such disease as hydrophobia has been denied; but no one who has once witnessed it, will, I think, be disposed to hold with that opinion.—J. F. S.

Professor **Dick's** views (*c*) in regard to hydrophobia are extremely interesting, though, as he says, "not a little peculiar; but being the result of considerable observation, and leading, as we conceive, to most important and beneficial results, we will neither conceal nor compromise our decided convictions. We hold, then, that rabies is essentially an inflammatory affection, attacking peculiarly the mucous membrane of the nose, and extending thence through the cribriform plate of the ethmoid bones, to the anterior part of the brain, so giving rise to derangement of the nervous system, as a necessary consequence: this train of symptoms, we consider, constitutes mainly, if not wholly, the essence of an occasional epidemic, not unlike some forms of influenza or epizootic; and the bite of a rabid animal is not, to another so bitten, the exciting cause of the disease, but merely an accidental concomitant in the prevailing disorder; and the disease, hydrophobia, produced in man, is not the result of any poison introduced into his system, but merely the melancholy, and often fatal result of panic fear, and of the disordered state of the imagination. Those who are acquainted with the effects of sympathy, and imitation, and panic, in the production of nervous disorders, will readily apprehend our meaning; and if our view be correct, the immense importance of disabusing the public mind on the subject is apparent. This is a task which we hope one day to accomplish. But in the mean while, considering the vast responsibility of promulgating these views, without the utmost certainty as to their truth, we shall not press them; nay, we shall, to any greater extent, withhold them at present, and shall now do all the justice our limits allow, to the elucidation of the prevailing, and what is generally considered, the established pathology and history of the complaint." (p. 95.)]

361. If the wound be still open, the outbreak of the madness is indicated by a change of its colour, and by the secretion of a thin pus, wherewith it itches and smarts, and these sensations spread over the whole limb.

If the wound have already scarred, an itching painful sensation begins

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(*a*) Quoted at head of article.

(*b*) Clinical Lecture on Hydrophobia; in Lancet, 1829-30, vol. ii.

(*c*) Manual of Veterinary Science. Edinburgh, 1841. small 8vo.; and in Encyclopædia Britannica. 7th Edit.

in it, which spreads from the wounded spot over the whole part, towards the neck, and upon the entire side of the body. The scar inflames, swells, breaks, and discharges an ichorous, foul-smelling pus. The absorbents and neighbouring glands are slightly swollen; the pain spreads rather in the course of the nerves. The parts often become paralysed, and slight convulsions take place in it. In some cases, however, no change occurs in the injured part. According to URBAN (*b*), besides the changes in the wound or scar already described, there should be always a circlet of small vesicles, from the size of a millet seed to that of a moderately large pea, containing a reddish or bluish fluid, and capable of propagating the same disease by inoculation.

362. With these appearances occur also faintness, heaviness of the limbs, dizziness, deafness, dimness of sight, shunning the light, heaviness, and great sensitiveness. The sleep is restless, broken by convulsive wakings and dreadful dreams; the face is disfigured, pallid; the eyes are dull, full of water, often motionless and reddened; the spittle frequently collects in the mouth; the pulse is small, irregular; the breathing is oppressed, broken with sighs; the voice hollow and trembling; there is nausea, disposition to vomit, actual vomiting of green bile, pain at the pit of the stomach; costiveness, and pale urine. After these symptoms have continued for a longer or shorter time, a burning internal heat comes on, great thirst, and dryness of the throat, abhorrence of all drinks, so that every attempt to take any fluid (1), and subsequently the very sight of water, or of any glittering object, the least breath of air, and so on, excites the most severe contraction of the throat, and convulsions (2). Spasm attacks the muscles of the neck especially, but often there is general tetanus. The patient can sometimes swallow fluids if he do not see them. Often is there an uncontrollable disposition to bite (3). Symptoms of actual raving may occur, in which the patient can scarcely be restrained, and screams and rages extraordinarily (4); but sometimes he is completely insensible till death. Clammy spittle flows from the mouth, or it is spit out, and collects like foam about the mouth (5). The patient can swallow solid food. Bilious vomiting frequently occurs. In men a disposition for connexion, and continued erection of the penis occurs. When the raving symptoms have passed by the patient feels exceedingly weak, the pulse is extremely small and frequent; some of the limbs are often paralysed, and the notion of his dreadful condition often brings the patient to despair, and even to seek self-destruction. Death at last follows (6), the symptoms continuing to increase, on the second or third day, rarely later, from wearing out, or from inflammation of the internal organs, or from palsy and apoplexy (7).

[(1) "They will in the true disease," as stated by ELLIOTSON, "generally make, too, the greatest possible efforts to overcome the difficulty of swallowing, and although they many times put the cup from their lips, their courage failing after they have promised to attempt to swallow, they will frequently at last, as in this case, by great effort, open the mouth, throw the head back, and gulp down considerable draughts of fluid in violent haste, even in the midst of their greatest difficulty of swallowing." (p. 289.)

(2) "The most characteristic, indeed, the peculiar feature of the disease," says ELLIOTSON, "that which is, perhaps, pathognomonic, is the effect produced on the diaphragm, and muscles of the throat by the slightest draught of air, the smallest sudden drop of fluid, or even by the slightest sudden touch that may be made with the finger upon any part of the body. * * * The effect of the cold air, etc., even that of a fly settling suddenly upon the skin, of a sudden strong light, the least agitation of the bed or bed-clothes, very much resembles that produced on us all, upon stepping into a cold bath. A sudden and involuntary inspiration is made, followed by several shorter ones; and, in a case of hydrophobia, the muscles of the throat are, at the same time, violently

contracted, so that the glottis violently closes and the attempts of the diaphragm to descend, and of the muscles of the chest to elevate the ribs, are frustrated from moment to moment. The closure of the glottis, however, is not continuous, but alternates with relaxation of the muscles, so that a succession of sobs takes place. These convulsive actions of the muscles of the glottis, and indeed of the throat in general, are dreadfully violent." (pp. 288, 89.)

Inflammation of the pharynx, or the apprehension of being affected with hydrophobia, may produce incapability of swallowing fluids, but the distinction consists in the absence of the catching of the breath. Upon this important point **Elliotson** remarks:—"From mere inflammation of the pharynx and surrounding parts, the muscles of deglutition are sometimes thrown into violent spasms, and the suffering from this source is so great, that even the offer of anything to be swallowed, (and of course it is fluids only which are offered, on account of their being more easy to swallow,) produces the same effects even in a mere nervous state of the system. From a groundless apprehension of the disease the same circumstances may occur. It is certain, indeed, that many cases of these two descriptions have been mistaken for hydrophobia; but in the mere inflammation of the organs of deglutition, the other—the great symptom—the great sensibility of the surface to the sudden impression of air, etc., is of course not present. Nor is it present in mere nervous irritability of these organs. When the spurious hydrophobia arises from mere apprehension of the disease, the fear of swallowing only is complained of, as it is this which is vulgarly known as the chief characteristic of the disease, and there is no morbid irritability of the surface to the impression of air. Indeed there is a mere inability to swallow, without that sudden catching of the breath which I have described." (p. 289.)

(3) I very much doubt the truth of the assertion here made by **Chelius**, as also by many other writers, of the patient's disposition to bite. Dr. **Powell**, indeed, mentions that his patient (a woman) *struck* and *threatened* to bite, and afterwards bit one of the attendants; and **Magendie** (*a*) also states the same fact. I can only say, that I have never seen a single instance in which any such attempt was made. But I recollect the younger **Cline**, when lecturing on the subject of hydrophobia, mentioned it as a remarkable fact, that animals affected with this disease are invariably disposed to use their organs of offence; that thus the dog bites, the horse bites and strikes with his feet, cattle and sheep butt with their horns, and man strikes with his fists. And he was accustomed to refer to the case of a patient labouring under this dreadful malady, in St. Thomas's Hospital, who, when some drops of water were thrown upon him by a bystander to notice what effects would result, instantaneously rushed out at the foot of his bed, bolt upright, in a paroxysm of fury, with his fists doubled and prepared to strike; but immediately recovering himself, asked pardon, and returned to bed. I have never been witness of such scenes, for unfortunately these cruel experiments (for they deserve no better name) have, in time past, been too frequently practised to doubt their issue, or to afford any apology for their repetition; and, therefore, the most scrupulous attention is paid to free the patient from every thing which can in the least degree tend to excite or increase his dreadful irritability.—J. F. S.

(4) **Elliotson** observes:—"There is also in this disease a *general* morbid irritability, so that the patient is, from time to time, in a violent passion bordering on frenzy; he is perhaps abusive, and even attempts to injure those about him; but in a moment again is calm, and apologises for his conduct. The degree of passion probably depends, in some measure, upon the natural temper." (p. 289.) "This kind of delirium," says **Youatt**, referring to that already observed in the dog, "is of frequent occurrence in the human patient. The account given by Dr. **Bardsley** of one of his patients, is very appropriate to our present purpose:—'I observed,' says he, 'that he frequently fixed his eyes with horror and affright on some ideal object, and then, with a sudden and violent emotion, buried his head underneath the bed-clothes. The last time I saw him repeat this action, I was induced to inquire the cause of his terror. He eagerly asked if I had not heard howlings and scratchings? On being answered in the negative, he suddenly threw himself on his knees, extending his arms in a defensive posture, and forcibly throwing back his head and body. The muscles of the face were agitated by various spasmodic contortions; his eye-balls glared, and seemed ready to start from their sockets; and at that moment, when crying out in an agonizing tone, "Do you not see that black dog?" his countenance and attitude exhibited the most dreadful picture of complicated horror, distress, and rage that words can describe or imagination paint.'" (pp. 247,8.) "One of Mr. **Babington**'s patients thought that there was a cloud of flies about him. 'Why do you not kill those flies?' he would cry; and then he would strike at them with his hand,

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(*a*) Journal de Physiologie Expérimentale, vol. i.

and shrink under the bed-clothes in the most dreadful fear." (p. 132.) The first symptom noticed in the Duke of Richmond was "early in the morning of the 25th of August, when his valet found him alarmed at the appearance of some trees, which were near a window of the room where he slept, and which he insisted were people looking in."

Lawrence notices a remarkable peculiarity in the delirium of hydrophobia:—"The patient is pursued by a thousand phantoms that intrude themselves upon his mind; he holds conversations with imaginary persons; he fancies himself surrounded with difficulties, and in the greatest distress. These thoughts seem to pass through his mind with wonderful rapidity, and to keep him in a state of the greatest distress, unless he is quickly spoken to or addressed by his name, and then, in a moment, the charm is broken; every phantom of imagination disappears, and at once he begins to talk as calmly and as connectedly as in perfect health." (p. 620.)

(5) The tenacity of the spittle observed in dogs, is generally observed in man; and, more commonly than otherwise, he is spitting continually in every direction, as I have several times seen. Youatt justly observes, that the patient "is sadly distressed by it, forces it out with the greatest violence, and in his attempts so to do, utters the falsely supposed bark of a dog." (p. 136.)

(6) "The duration of the disease," says Elliotson, "when distinctly formed, generally varies from rather less than twenty-four hours to six or seven days. I have had two patients with it, both little girls, and each died in less than twenty-four hours; the present patient died in rather less than six-and-thirty. The difference does not depend upon age; because two American cases are recorded, the one of a person under four, the other of a person seventy-three years old, who each lived six or seven days. The greater number, however, die on the second, third, or, at the latest, the fourth day. The suddenness of the present death was nothing more than has been frequently observed. Patients sink in general at last very rapidly, and often die before it is expected." (p. 290.)

(7) Meade observes:—"When the symptoms are maniacal, the strength of the muscles is prodigious; these acting, indeed, with a convulsive force so great that I have seen a case, in which a man tied down in bed with strong cords broke them all at once by one effort, and immediately died paralytic." (p. 136.) I remember also a case some years since, in which a patient labouring under hydrophobia, rushed through his attendants, and ran out in his shirt, with the blood streaming from his arm, into the open air, a distance of a couple of hundred yards, before he could be overtaken, and died immediately on being put to bed.—J. F. S.

Elliotson makes a most important observation, as to the possibility of hydrophobia proceeding to a certain stage and then subsiding. "Usually," says he, "I believe, there are symptoms of weariness, general indisposition, dizziness, chills, and flushes, sometimes a pain has been felt in the bitten part. I think it very possible, from an occurrence which happened in my own practice, that these symptoms may go no further; that the disease, if I may so speak, may go off. Two little girls, standing at their father's door, were bitten by the same dog; a strange dog passing snapped at both of them, and bit them both in the face. She who was bitten the second, became hydrophobic and died. The other, at exactly the same time, experienced the same premonitory symptoms as her sister, heaviness and general indisposition; but they all went off." (p. 290.) Does not this tend to confirm Meade's observation:—"Neither will it seem strange that a poison so different in its force, and so alterable by many circumstances, should in some subjects produce symptoms of the same convulsive kind, yet *not to such a degree as to hinder deglutition*, and these, too, only at particular times. A soldier of a strong habit of body came to me not long since, who once a month was seized with a great anxiety, palpitation of the heart, and difficulty of breathing. He had been bitten by a mad dog about six weeks before he began to complain. By bleeding, cold bathing, the powder of lichen with pepper, and volatile medicines, during the oppression, the fits were every month less violent, and at last quite left him." (p. 151.)

Dr. J. L. Bardsley (a) divides hydrophobia into three periods, viz., the stage of *delitescence*, the stage of *recrudescence*, and the stage of *spasm*. In the *delitescent* stage "there are generally few symptoms to be observed, except such as are usually found to occur from the bite of the most healthy animal. * * * In most cases, however, pain has been felt in the cicatrix a considerable time after the accident; but such a feeling is so frequent in the seat of wounds recently healed, that its occasional presence after the bite of mad animals ought not perhaps to be considered as anything singular or characteristic. * * * In the period which intervenes between the healing of the wound and the second stage, little satisfactory has been observed." (This stage is called by Youatt the stage of *incubation*). In the *recrudescent* stage, "at first a pain is perceived in the

(a) Quoted at head of Article.

cicatrix, at times attended with itching, but in general resembling the aching of rheumatism, which, in some cases, shoots to some distance along the limb affected, and in others degenerates into a species of torpor in the part itself. * * * The scar becomes red, swollen, sometimes livid, and in one case (a) was surrounded by papulary eruption, and in the course of a short time it opens and discharges a peculiar ichor. Meanwhile flying convulsive pains are felt in various parts of the body. As the disease proceeds, the patient, according to Dr. Marcet, complains of pains shooting from the wound to the heart, and in general both he and Babington, with Professor Callisen, have observed in different cases that these recrudescent pains seem always to follow the course of the nerves, and do certainly never inflame or irritate the lymphatic vessels and glands in the vicinity, though passing in a parallel course towards the trunk. * * * It is seldom that they occur longer than six days before the disease becomes marked, and the more general term of their appearance seems to be two or three days before hydrophobia supervenes." The *spasmodic* stage presents the hydrophobic phenomena.

"The whole of the symptoms above expressed may establish themselves in a few hours after their commencement, though in general they can scarcely be said to become so fully developed before the second day, and death most usually happens in this and the third according to Hamilton's table, although in a considerable number it has taken place after twenty, twenty-five, or thirty-six hours, and in others it does not happen before the fifth day, and in some few instances not before the eighth or ninth day." (p. 491–95.)]

363. On examination of the corpse, the nerves and their sheaths, in the neighbourhood of the wound, have been found inflamed, and their medullary substance discoloured (*b*), inflammation of the neck, of the epiglottis, of the ganglions of the nerves of the neck, redness of the *nervus vagus*, *sympathicus*, and *phrenicus;* further, inflammation of the membranes of the brain, and watery extravasation between them; the mass of the brain drier than usual, and its vessels loaded with black blood; frequently, inflammation of the heart, adhesion of it to the *pericardium;* the heart empty or loaded with coagulated blood; the lungs inflamed, adherent to the *pleura*, often dry; gangrenous inflammation in the stomach and other intestines. The salivary glands are not diseased. The corpse speedily becomes putrid; the muscles are dusky red, even when much blood has been withdrawn, and the blood has a peculiar fluidity, by means of which it passes into the most minute vessels. In many cases, however, nothing unnatural is observed (*c*). The scar of the bite often appears swelling with coagulated blood, especially when during life it has been much inflamed.

Locher (*d*) has found in all mad dogs, upon the spleen, vesicles of different size and form, containing a pale yellowish lymphatic fluid, and covering the entire surface, together with traces of inflammation in the spleen.

[In the examination of Elliotson's patient it appeared that "the *medulla oblongata* was rather softer than usual, and so were the *corpora striata* and the *thalami nervorum opticorum*, but the middle lobes were likewise softened. The phrenic nerve and the par vagum appeared perfectly healthy, as did the whole of the spinal marrow. The cardiac half of the stomach was redder than usual, but not redder than we continually see it after affections of the respiratory organs. The œsophagus was quite healthy. The larynx and adjoining parts, and the whole of the lungs, were in a state of congestion, and the corpse was that of one who died after struggling. The hands were clenched, and the lips turgid and blue. The heart was strongly contracted. The spasmodic attacks which took place were quite sufficient to cause the congestion observed in these parts, though, were they not so, the congestion would not explain the peculiar symptoms." (p. 292.)]

364. As to the proximate cause of hydrophobia, it is probable that it consists in an active, quick-running inflammation of the nerves, specially of the ganglionic system, and thereby the diseased disturbance of the animal

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(a) Edinburgh Medical Journal. 1807.

(b) Cherardini; in Abhandlungen für praktische Aerzte, vol. xv. p. 57. Metzger (Autenrieth), De hactenus prætervisa nervorum lustratione in sectione hydrophoborum. Tubingæ, 1802.

(c) Horn; in Archiv. für Medic. Erfahrung, 1821, Jan. Feb., p. i.

(d) Dissertatio exhibens magnum Lienis in hydrophobia momentum. Goettingæ.

instincts, as well as the similarity of the symptoms of hydrophobia, with those of tetanus and several other nervous affections, is accounted for.

As to the different opinions on the nature of Hydrophobia, see **Harle** (*a*).

Harder(*b*) proposes the question whether it be not possible, and even probable, that the poison brought in the course of absorption from the bite into the circulation, may not there remain for some time without exciting peculiar reaction; but when it is again deposited in the spot of the original inoculation, whether it do not excite the known symptoms preceding the outbreak of madness, and finally herewith produce, by inflammation of the nerves, by sympathy, or some other means, the symptoms of hydrophobia? Applicable to this question is a case where the symptoms of hydrophobia, which had distinctly established themselves, disappeared speedily after the excision of the scar. They reappeared upon the growth of a spongy and acutely painful knot which sprouted from the wound, but after its removal and a suppuration of some considerable time the patient recovered.

Langenbeck (*c*) considers hydrophobia to depend on a qualitative alteration of the blood from the transport of the poison from the infected bite into the mass of the blood, in which nature, struggling to separate the poison, brings the salivary glands into play, which prepare a spittle containing the contagious matter.

365. If the wound be impregnated with the poison, the prognosis is always extremely doubtful. Everything depends on destroying the poison in the wound, and preventing its operation on the general organism. If hydrophobia have already broken out, art is but very seldom capable of rendering assistance, and the less as the disease sets in more quickly or its symptoms are more severe.

366. The complete excision of the wound is the most certain for the removal of the poison, and for preventing its influence on the whole body; or, when this cannot be done, the quick cleansing of the wound and its entire neighbourhood with water, salt water, water and vinegar, and so on, long continued; in small wounds a longitudinal enlargment must be made, and the bleeding kept up by cupping-glasses or warm water. The whole wound must then be thoroughly cauterized with the actual cautery, butyr of antimony, caustic ammonia, caustic potash, or with gunpowder, which is to be inflamed. The slough is to be soon removed, and a free suppuration kept up for many months, by scattering powdered cantharides, and by irritating salves, and by rubbing in mercury about the whole circumference of the wound till ptyalism is produced. The same mode of treatment must be employed if the wound already closed begins to smart and swell.

The various remedies which have been just mentioned as especially efficient for cauterization, owe this preference to their active operation, and the possibility of applying them in the different-shaped wounds; so that every part of the wound may be sufficiently deeply cauterized. In this respect butyr of antimony and caustic potash are most preferable.

[**Youatt** is no advocate for excision, and observes:—"This operation demands greater skill and tact than is generally supposed. It requires a determination fully to accomplish the desired object, for every portion of the wound with which the tooth could possibly have come into contact must be removed. This is often exceedingly difficult to accomplish on account of the situation and direction of the wound. The knife must not enter the wound, or it will be likely to be itself empoisoned, and then the mischief and the danger will be increased instead of removed. Dr. **Massey** was convinced of the impropriety of this when he advised that 'should the knife by chance enter the wound that had been made by the dog's tooth, the operation should be recommenced with a clean knife, otherwise the sound parts will become inoculated.' If the incision is made freely and properly round the wound, and does not penetrate into it, yet the blood will follow the knife, and a portion of it will enter into the wound caused by the

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(*a*) Ueber die Behandlung der Hundswuth, und insbesondere über die Wirksamkeit der Datura-Stramonium gegen deiselbe. Frankfurt, 1809. 4to.

(*b*) Vermischte Abhandlungen aus dem Gebiete der Heilkunst von einer Gesellschaft praktischer Aerzte zu St. Petersburg. Petersburg, 1821. p. 173.

(*c*) Nosologie und Therapie der chirurgischen Krankheiten, vol. iii. p. 843.

dog, and will come into contact with the virus, and will probably be contaminated, and will then overflow the original wound, and will be received into the new incision, and will carry with it the seeds of disease and death; therefore it is, that scarcely a year passes without some lamentable instances of the failure of incisions. It has occurred in the practice of the most eminent surgeons, and seems scarcely or not all to impeach the skill of the operator. Aware of this, there are very few human practitioners who do not use the caustic after the knife. Every portion of the new wound is submitted to its influence. They do not consider the patient to be safe without this second operation. But has the question never occurred to them, that if the caustic is necessary to give security to the operation by incision, the knife might have been spared, and the caustic alone used?" (pp. 146-7.) I do not, however, think his objections to the removal of the parts by the knife are sufficient, neither do I believe there is so much to be feared as he suspects of the contamination of the blood by the virus. I have no doubt that when the disease appears after excision has been performed, that it is because all the infected part has not been removed, the surgeon having cut neither sufficiently widely above nor below the wound. If the operation be not performed immediately, or within a very few hours, it is absolutely necessary that all the skin which has an inflamed appearance should be removed; and, as the operation even in the best hands is frequently a niggling and tedious business, and the blood smeared over the skin tinges it so that the precise extent of the inflammatory blush is rendered indistinct, a part of the irritated or inflamed skin is easily left behind, and with it *perhaps* the seeds of the disease. To prevent this serious difficulty my esteemed master, Henry Cline, was accustomed to give directions for the performance of this operation which seemed trivial and useless, but were far otherwise; for in the treatment of the bite no attention, however minute, can be too great. He directed that to prevent the possibility of any reddened and inflamed skin being left behind, it should be encircled with a ring made with lunar caustic, the speedy blackening of which marked the whole part to be removed, and the incision to be made around and clear of such ring. To remove the very bottom of the wound a probe or a skewer was to be thrust down as far as possible, and then all the soft parts carefully cut round it, so that they might be brought out like a glove-finger upon the probe or skewer, without cutting into the wound. This plan is that which I have adopted in the opportunities which I have had in operating early on these cases, and I believe it to be the only safe proceeding, and the only way by which the whole of the infected part can be surely determined to have been removed. The subsequent free application of caustic potash is also advisable, as being the most sure means of destroying any small quantity of the poison which may have been smeared over the fresh wound during the operation, or which may have escaped the knife. I do not believe that there is any danger of "the virus being suspended, or lying in the caustic, potash, or nitric acid, (if that be used,) or of it being precipitated upon the living fibre beneath," (p. 147,) as Youatt fears. The caustic of either kind must destroy the virus with which it comes in contact, as completely if not more so than the lunar caustic, the use of which Youatt advocates. And it fails, when it does fail, because it does not find its way into every crack and cranny into which the poison has found its way.

The knife is always to be used, where there is plenty to cut away, as in fleshy parts, but in wounds, or rather superficial scratches with the teeth upon the face, some surgeons prefer using caustic potash. I would not even on the face, however, make an exception to the use of the knife, for to do any real good, a scar, often a large one, must be made, and as it is of no consequence by what means this is produced, the knife is preferable. If the lip were bitten, I should consider it right to remove its entire thickness by the same operation as for hare-lip; and if the cheek I should not hesitate as the safest and surest proceeding to cut the whole part through into the mouth, and then there would be neither difficulty nor danger in bringing the edges of the wound together with pins, and confining them with the twisted suture. If the finger, hand, or foot, were bitten through, I myself would readily submit to amputation of the injured part. No operation can be considered unadvisable, or too severe, which will give a patient the slightest chance of security from this most dreadful disorder. Half measures on the part of the medical attendant are here actually criminal, and no surgeon who has once witnessed the awfully horrible and hopeless condition of a hydrophobic patient, will, I am sure, if he do his duty, neglect this the most sure remedy he can employ to ward off the possibility of the poison being retained in the system.

My friend Sams tells me, that he knew a young lady in India twenty years ago, who when a child, three years of age, was bitten in the neck, just above the insertion of the *m. trapezius*, by a mad pariah dog. The station where she lived was forty miles distant from a medical man; but before his arrival, her father, a civilian, with much presence of mind, sliced out the bite wound with a razor, and then applied a heated table-knife over the bleeding wound to cauterize it; and he had the happiness of saving his child from this most dreadful disease. I mention this case, in hope that should this book fall into the hands of unprofessional persons, they may see how they may be able to help themselves, or those dear to them, when medical aid is not at hand.

Another very important point to be borne in mind is, that the scar should be always removed, whenever the patient informs his medical attendant that he has been bitten by a suspicious animal. That the poison often remains quiet *in* the part beneath the scar for weeks and months, and that when the disease is about setting in, the scar and its immediate neighbourhood become irritable and inflamed, and that the scar opens and discharges, and speedily after the hydrophobic symptoms appear, has been so frequently observed as to be past all doubt. The scar should therefore be cut out, and as much of the surrounding and subjacent parts removed with it as the surgeon may judge necessary, at any time before it has begun to be irritable, or before the symptoms appear. Some persons, indeed, advise that it should be cut out even after the disease has commenced. This practice may certainly be permitted, but I fear the probability of benefit from it is but little.—J. F. S.]

367. Besides this local treatment, many remedies are advised for internal use in order to prevent the outbreak of the hydrophobia. Hereto belong a diaphoretic condition, the internal use of cantharides, of belladonna, of mercury to salivation, of camphor, of oil beetles, (*meloe proscarabæus*,) of *liquor ammoniæ*, free rubbing in olive oil and so on. The use of mercury to salivation seems most to be relied on (*a*), and of cantharides or belladonna from one or more grains, gradually increasing the dose till traces of their narcotic effect are produced (*b*).

Wendt (*c*) recommends especially the following mode of treatment proposed by Dr. Kruttge; wash the wound with a sponge soaked in lukewarm water, fill it entirely with powdered cantharides, and over this a plaster of the same extending half an inch beyond the wound; half a grain to a grain of calomel every four hours and also at night; rubbing in mercurial ointment to a scruple or half a drachm morning and evening, the first time upon the wound, afterwards upon the other limbs. The vesications produced by the blister-plaster are to be cut away with scissors, the foul powder to be removed, and whether the wound be superficial or deep, the powder is to be strewed on it afresh or the part deprived of its cuticle bound up in *emp. canthar.*; this is to be continued six weeks, attention being paid to the irritability of the patient. The calomel and rubbing in are to be continued till salivation and swelling of the gums are produced, and the daily loss of a pint of spittle; then no more ointment is to be rubbed in, and enough calomel only is to be given to keep up a sufficient salivation. After six weeks a pea issue is to be established. Of 184 persons bitten only two died some weeks after of hydrophobia.

The root of the belladonna has been of late especially recommended by Brera and von Schallein. Brera (*d*) employs the belladonna in the largest doses of three drachms every twenty-four hours; and every patient uses about eight ounces and sometimes more; at the same time calomel or sublimate are employed internally, and mercurial friction externally. Von Schallein (*e*) chooses scarification of the wound, bleeding, deep burning with actual cautery, and binding up with an ointment composed of twelve grains of camphor, two scruples of oil of turpentine, two ounces of basilicon ointment, eight grains of red precipitate, and four scruples of powdered cantharides. If the actual cautery cannot be perfectly applied, the wound, after having been scarified and let bleed, must be burnt with butyr of antimony, which is to be repeated after two hours, and then bound up with ointment, which must be repeated morning and evening to the fourteenth day. The same treatment must be employed if the wound be only

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(*a*) Walther, über die Heilkraft des Quecksilbers bei dem Starrkrampfe und nach dem tollen Hundsbisse; in his Abhandlungen aus dem Gebiete der praktischen Medecin, besonders der Chirurgie und Augenheilkunde, Landshut, 1810. vol. i. p. 169.

(*b*) Münch, Praktische Abhandlung von der und sie zu heilen. Baireuth, 1824. 8vo.

(*c*) Darstellung einer zweckmässigen und durch die Erfahrung erprobten Methode zur Verhutung der Wasserscheu nach dem Bisse eines tollen Hundes. Breslau, 1824. 8vo.

(*d*) Commentario clinico per la cura dell' Idrofobia; in Mem. della Soc. Ital. delle Scienze residente in Modena, vol. xviii. Also in Omodei, Annali Universali, vol. xix. p. 60.

(*e*) Anweisung der Hundswuth auf eine durchlange Erfahrung erprobte Wesei sicher vorzubauen Belladonna und ihrer Anwendung, besonders zur Verbannung und Heilung der Hundswuth. Götting., 1785.

bruised to blue redness. At the same time a dose, proportional to his age, of belladonna root, calomel, cajeput oil, and sugar must be given to the bitten person. And for a drink, ℞ *herb. et flor. anagall. arvens.* ℥iij., *rad. bardan.*, *saponar. ana* ℥jss., *liquirit.* ʒiij. *stip. dulcam.* ʒvj., *sem. anis.* ʒj. : *misce*. Of this three heaped up table-spoonfuls are to be well boiled in two and a half quarts of water. The belladonna is to be increased every day according to the age and constitution of the patient, about a quarter to half a grain, or even to a whole grain, till it produce incipient double vision and giddiness. When these symptoms have come on sharply, the belladonna is not to be increased, but the same dose to be continued to the fourteenth day. If the symptoms be diminished previous to the fourteenth day, the dose of the belladonna must be again increased, in similar proportions, till it again resumes its full power, and to be continued to the fourteenth day. The dose of the calomel and cajeput oil is not to be changed. From the fifteenth day the belladonna is to be again diminished, as it has been increased, till the doſe have returned to that with which it was commenced; and this is to be continued to the twenty-eighth day. From the fifteenth day the wound is to be dressed only once with the above ointment; from the twenty-eighth day to its complete cure, with an ointment of three drachms of *ung. basilic.* and five of *ung. altheæ.* The drink is to be made fresh every day, and drank daily in sufficient quantity till the wound is healed.

368. According to the observations of Marochetti (*a*) and others, little bladders and knots should form, on both sides, beneath the tongue, upon the ducts of the sub-maxillary glands, upon the third, fifth, seventh, and ninth day, and even later, on the twenty-first, and even to the thirty-fourth day after the bite of a mad beast. These little bladders appear on the sides of the frænum, one or more often on the side corresponding to the bite; sometimes they occur upon the upper surface of the tongue. They are small, round, or oblong pustules, which project, are irregularly large as linseed, or even as a pea; are generally transparent and fluctuating, but often opaque; of a brownish white colour, and more or less knotty. At their commencement they exhibit no very diseased appearance; they soon subside, often after thirty hours, or at least lose their fulness, their crystalline and fluid form, and then the other symptoms set in simultaneously. If these vesicles be not opened within the first twenty-four hours after their appearance, the poison is absorbed, and the patient lost. We should therefore look beneath the tongue of the bitten person twice a-day for six weeks, during which time he must take daily a pint and a half of strong decoction of the tops and flowers of *genista lutea tinctoria*, or, four times daily, a drachm of *pulvis genistæ*. If vesicles do not appear during this period hydrophobia is not to be dreaded; but, if they appear, they must be opened with a lancet, burnt with the actual cautery, and the patient may gargle with the *decoct. genistæ*. These very important observations, the correctness of which have been frequently and by myself confirmed in a sufficient number of cases which have come under my observation, must not, however, by any means restrict the local treatment of the bite (*b*).

(*a*) Observations sur l'Hydrophobie : Indices certains pour reconnaître l'existence du virus hydrophobique chez un individu et moyens d'en prévenir le développement en détruisant le germe; in Vermischte Abhandlungen aus dem Gebiete der Heilkunst von einer Gesellschaft, &c. Petersburg, 1821. Vol. I.

(*b*) Dr. Mayer, ibid., vol. ii. p. 88.
Rust's Magazin, vol. x. p. 189.; vol. xvi. p. 149.
St. Petersburg Zeitung. 1823, 14th Aug.
Xanthos; in Hufeland's Journal. 1824. March.
Amelung; ibid., 1824, Dec., p. 88.
Omodei, Annali Universali di Medicina. June, 1825.
Erdmann; in Hamburger Magazin der ausländl. Liter. vol. v. p. 293.
Magistel; Journal de l'Hôpital de Burlay; ou Mémoire sur l'Hydrophobie. Saintes, 1823.—Journal Général de Médecine, Sept. 1823.
London Medical and Physical Journal. Feb. 1825.
Laennec; in Révue Medicale. Feb. 1824.
Baumbach; in Rust's Magazin, vol. xv. p. 109.
Ettmüller und Ideler; ibid., vol. xvi. p. 109.
Benorde und Müller; ibid., vol. xxi. p. 294.
Deutschert; ibid., vol. xx. p. 560.
Schlüter; ibid., vol. xxii. p. 508.
Söchting; ibid., vol. xxiv. p. 492.
Rust; in his Magazin, p. 403.

[Watson's opinion of Marochetti's theory is, I apprehend, more correct than Chelius's, and his mode of explaining the appearances fully borne out. He says, "This was a very pretty theory, and took mightily in the medical world. But it has turned out a sort of hoax. I do not mean a wilful hoax on the part of Dr. Marochetti, for I have no doubt that he contrived to hoax himself. These pustules have been looked for again and again; but they have never been discovered in Englishmen affected with hydrophobia, nor in English mad dogs. The truth seems to be, that the mucous follicles of the mouth generally, and those at the base of the tongue, and those beneath the tongue in particular, are commonly enlarged and exaggerated in the dog, and in the human animal, labouring under the disease; and these enlarged and altered follicles were regarded by the Russian physician as a specific eruption, which furnished the virus and pabulum of the complaint." (pp. 605, 6.)]

369. In addition to the above-named remedies, opium, musk, and many other anti-spasmodic substances, stramonium (*a*), cantharides, fluid alkalies, large bleedings, cold plunging-baths at the onset, and a number of secret and vulgar remedies have been recommended after the breaking out of the hydrophobia. Experience speaks most in favour of bleeding at the onset of the disease, even to faintness, and its repetition at every fresh outbreak, as well also as for the simultaneous use of mercury to salivation, of belladonna and of laurel water in very large doses (*b*). The wound or scar should always be treated in the way heretofore laid down.

There still remain to be proved the use of chlorine (*c*), the injection of warm water into the veins after bleeding (*d*), the internal use of lead in large doses (*e*), and the employment of a Russian vapour bath of 50° of heat for an hour (*f*).

VII.—OF TETANUS.

Trnka de Krzowitz, Commentarius de Tetano. Viennæ, 1777.

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Stutze, Abhandlung über den Wundstankrampf. Stuttgard, 1804. 8vo.

Larrey, Mémoires de Chirurgie Militaire, vol. i. p. 235, vol. iii. p. 286.

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Bergamaschi, G., Sulla Mielitide e sul Tetano, loro identita, etc. Pavia, 1820. 8vo

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Pelletier, A. B., Mémoire sur la nature et le traitement du Tétanos traumatique; in Révue Médicale. 1827, Nov. Déc.

Bardsley, J. L., Dr., Article *Hydrophobia*; in the Cyclopædia of Practical Medicine. 1833.

Travers, Benj., Article *Tetanus*; in his Further Inquiry concerning Constitutional Irritation. London, 1835. 8vo.

Hunter, John, The Works of, by Palmer. Lectures, vol. i.

Curling, T. C., On Tetanus. London, 1836. 8vo.

370. The Tetanus following wounds (*Tetanus traumaticus*, Lat., *Starrkrampfe*, Germ., *Tétanos traumatique*, Fr.) is one of the most dangerous

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(*a*) Harles, über die Behandlung der Hundswuth, und inbesondere über die Wirksamkeit der Datura-Stramonium geger dieselbe. Frankfort, 1809. 4to.

(*b*) von Schallein, *loc. cit.*, p. 160.

(*c*) Julius und Gerson, Magazin der ausländischen Literatur. 1822, July, August.

(*d*) Magendie, Journal de Physiologie, vol. iv. p. 132.

(*e*) Fayermann; in Annals of Philosophy, 1824, Sept., p. 232.

(*f*) Froriep's Notizen, vol. xi. p. 224.

complications to which wounds are subjected. It presents itself in various forms, either as cramp, attacking all the muscles, or only the flexing and extending muscles. There are, therefore, distinguished, 1. *Tetanus*, in which there is simultaneous spasm of the whole body, and the patient stretched straight out lies perfectly immovable; 2. *Emprosthotonos*, in which the bending muscles of the trunk are affected with cramp, and the body is brought together forward in a half circle; 3. *Opisthotonos*, where the trunk is curved backwards; and, 4. *Pleurosthotonos*, in which, by the spasmodic contraction of the muscles on one side, the body is curved to that side. *Tetanus* is most frequent; *Emprosthotonos* more rare than *Opisthotonos*, and *Pleurosthotonos* least common of all.

["The traumatic tetanus," says TRAVERS, "is a more severe disease than the idiopathic tetanus. It has a mild and slow, and a severe and rapid form; the former gradual in approach, often partial, or partially diffused, unattended by fever or even quickened circulation in the intervals of the paroxysms, losing much of its danger after four days' duration. and disposed to become chronic and curable by support; the latter universal, with shorter intervals of spasm, attended with greatly accelerated circulation, in almost all cases resisting remedy, and speedily even suddenly destructive. The period of accession after injury varies from an hour to ten days or a fortnight. In some rare instances it is almost immediate. The case of a negro is recorded by Dr. ROBISON, in which the spasms commenced in a quarter of an hour after the infliction of a puncture with a fragment of chinaware; and some years ago a man was brought into St. Thomas's Hospital for a recent fracture, in a state of universal tetanus of tremendous violence, which proved fatal in a few hours. The fracture was an oblique one of the thigh-bone, which, penetrating the *rectus* muscle, was continually playing through its belly in a see-saw. (p. 292.) In flesh wounds the period of commencing cicatrization, after the mundifying process is completed, seems to be most liable to the attack of spasm; not unfrequently the punctured wound, as from a nail, wears the aspect of being healed, and is almost forgotten when the spasms set in." (p. 294.) BRODIE (*a*) mentions the seventeenth day, as the latest period after the accident, in which he had known tetanus come on. Sir JAMES M'GRIGOR (*b*) notices a case twenty-two days after, and BLANE (*c*) speaks of it as happening within a month.]

371. The course of tetanus is sometimes more quick, sometimes more tedious, usually three stages may be distinguished.

In the *first* stage spasmodic contraction of the muscles of the larynx and of the neck appears; the voice is altered, swallowing prevented, without apparent inflammation of the gullet, the muscles of the face are drawn, and subsequently there is a continued spasm of the masticatory muscles or lockjaw (*trismus*). Less constant symptoms are shooting pains over the whole body, stiffness of the limbs, trembling, *subsultus tendinum*, and so on. The wound often becomes irritable, dry; but often is unchanged.

372. In the *second* stage the cramps increase, and the proper form of tetanus sets in. The trismus becomes so severe that the jaws can be opened neither by the patient nor by other aid. The region of the masseter muscles is tense, painful, and swollen, the lips are thick and drawn together; the eyelids are closed, the pupils are very narrow, and the dread of light very great; the eyeball is motionless, often moved convulsively, and at last directed completely upwards. The countenance of the patient is entirely altered, heavy, generally bright red; and one or other corner of the mouth is drawn. The belly is mostly hard and drawn in; there is retention of stools (1) and also of urine.

The most severe pains come on by paroxysms in the course of the nerves and of the limbs, with wandering cramps, and convulsions. At first these paroxyms are rare; but subsequently they recur with scarcely any per-

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(*a*) Clinical Lecture; in Medical Gazette, vol. ii. p. 344.

(*b*) Med.-Chir. Trans., vol. vi. p. 453.

(*c*) Diseases of Seamen.

ceptible intermission. In the quick course of tetanus there is complete loss of sleep; but, when it is more protracted, the sleep is restless, anxious, and short. The voice is always indistinct, and quite faint. Swallowing becomes more difficult, impossible; and there is often the same dread of fluids as in hydrophobia.

["It has been observed," says **Lawrence** (*a*), "that a state of costiveness precedes tetanic symptoms; and Mr. **Abernethy** has made this a particular subject of inquiry; at least he has pointed out this question as one that should be held in view in the pathological consideration of the subject; that is to say, he has made it our business to inquire what is the condition of the digestive organs of the patient prior to the occurrence of the tetanic symptoms,—between the receipt of the injury and the development of tetanus? Obviously, himself, being of opinion that the injury, in the first place, produces derangement of the digestive organs, that that deranged condition of the digestive organs disturbs the spinal cord, and probably the whole system; and further, perhaps, that this derangement of the spinal cord and system is the affection which constitutes tetanus. This seems a rational and probable conjecture as to the mode in which tetanus is produced." (p. 587.)]

373. In the *third* stage, the muscles of the chest and the diaphragm are attacked with cramp. Respiration is checked, the circulation of the blood is irregular, and death ensues, either suddenly, in which case the cramp attacks the heart, or from apoplexy, or from palsy.

["As tetanus appears to attack parts not necessary to life, it seems strange" observes **John Hunter**, "how it kills; and, seemingly, the patient is in good health at the time, without inflammation, and with a good appetite; and yet, though not starved to death, from the difficulty of deglutition, it kills; however, it is sometimes combined with other diseases, and then it is difficult to say which disease kills; but when it is alone, the following seems to be the case: the disposition increases, and the effect, spreading to vital parts, affects the muscles of respiration, as the diaphragm and intercostal and abdominal muscles, as we see in gout when it attacks a vital part." (p. 587.)]

374 At first the tetanic patients are perfectly sensible; in the subsequent course of the disease the conceptions are confused. There is always some irregularity of the pulse. If fever and internal inflammation be present, the pulse is hard and quickened, and the result is generally soon fatal. Tetanus often destroys in from two to four days; frequently it continues longer, and even for several weeks.

[**Samuel Cooper** (*b*) mentions a case, under his care, of a patient who lingered five weeks with chronic tetanus before he died. (p. 1229.)]

375. The proximate cause of tetanus is very probably an inflammatory condition of the nervous system; at least the examination of bodies has shown inflammation of the nerves and their sheaths, of the spinal marrow and brain, with effusion of a watery fluid between their membranes. The spinal marrow, especially, is found affected, and if, in all cases, there be not traces of distinct inflammation, there may be, however, a state of simple irritation or congestion. In one case I found the most decided signs of inflammation in the spinal marrow, and itself dissolved to the extent of an inch into a pultaceous mass.

Froriep, R. (*c*), considers local nervous inflammation as the cause of tetanus and supposes that the general nervous irritability arises secondarily from it in the course of the nervous trunks, and that it is kept up till the patient is exhausted. He had observed in seven cases a direct injury of a nerve from pressure or immediate wound. The injured nerve always shows a peculiar inflammation, knotty swellings and redness on several parts of its course. In one case of wound of the inner plantar nerve, the tetanic cramp could be produced at will by pressing on the posterior tibial nerve at the inner ankle. **Friederick** (*d*) has collected cases which prove inflammation of the nerves in traumatic

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(*a*) Lectures in Lancet, 1829, 30, vol. i.

(*b*) Surgical Dictionary.

(*c*) Neue Notizen, 1837, Jan. No. I.

(*d*) Diss. de Tetano traumatico. Berol, 1837. For the literary history of Tetanus, in **Casper's** Wochenschrift, 1828. No. 29, 30.

tetanus, and has referred to the participation of the reflected function at the onset of this disease. **Curling** (*a*) considers it as a simple functional disturbance, the seat of which is the *tractus motorius* of the spinal marrow.

[I have seen in two cases of tetanus thin plates of bone upon the arachnoid coat of the spinal marrow, and in another similar plates of cartilage. These cases I dissected, and the preparations are in St. Thomas's Museum. But I have examined many other cases in which no such appearance presented itself, nor indeed any other which would have been considered disease, had not the attention been especially directed to it. Hence I am fully disposed to concur with **Lawrence**, that "we are at a loss, we are unable to point out with any degree of clearness, in what the derangement of the spinal cord consists; nor can we show, in any definite manner, as far as our examinations have hitherto gone, any distinct or clear derangement of that part." (p. 587.)—J. F. S.]

376. The remote causes of tetanus are very various. It is mostly connected with wounds of fibrous ligamentous structures (1), accompanied with tearing, bruising, partial injury and exposure of nerves; with wounds of joints, of the face, neck, fingers, toes, of the spermatic cord (2); it usually begins during the suppurative period, and even during or after the scarring of the wound. Foreign bodies into the wound (3), especially splinters of bone, ligatures of arteries, if a nerve be included in the ligature, are all to be considered as not unfrequent causes of tetanus (4). Likewise hot seasons of the year, cold, frequent change of the temperature, especially in low districts and in the neighbourhood of rivers, and the influence of a moist, cold, foul air upon nerves after their exposure by the separation of sloughs, emotions of the mind, especially terror. Young rustics are especially subject to tetanus.

[(1) "The cases (of tetanus) which I have seen," says **John Hunter**, "from wounds, were those of the tendons, for these parts heal less readily, and the constitution is much weakened by wounds of such parts, so that sometimes a limb will waste from such a cause,—wounds being much more irritable here than in other parts, and particularly when attended with loss of blood. Nothing produces irritability more than a great loss of blood, especially when accompanied with a wound, and with this disposition of constitution. The wounds producing it are either considerable or slight: the first is a predisponent, the second an immediate cause. When I have seen it from the first, it was after the inflammatory stage, and when good suppuration was come on; in some where it had nearly healed, and the patient was considered healthy, under the disease as well as before. Some have had locked jaw after the healing was completed. In such I have supposed the inflammation was the predisponent cause, rendering the nervous system irritable as soon as it was removed. * * * In the case of slight wounds there must already exist a predisposition, which only requires an immediate cause to bring it into action. The disease oftener arises from slight wounds than large ones, which may partly, but not entirely, arise from such being most frequent." (pp. 585, 86.)

(2) To these **Travers** adds:—"Ligature of the *funis umbilicalis*; of the entire spermatic cord, and the anterior crural nerve. The former is common in hot climates; the two latter I have myself seen." (p. 294.)

(3) **John Hunter** relates a remarkable instance of this kind. "A man had a locked jaw about a fortnight after a nail entered the sole of his foot, which he did not at the time regard as of any consequence, the wound not being larger than that from bleeding, and not attended with any pain, inflammation, or hardness. He died; and after death I found a black line continued to a hard body under the skin, which could be dissected out almost like a lymphatic gland, and was found to be a bit of leather, surrounded by coagulable lymph; the black line was the mark of the nail." (p. 586.)

(4) **Travers** says he "never knew nor heard of a clean incised wound inflicted without concussion, as by a surgeon's knife, in operation, producing tetanus, whatever was the structure divided." (p. 294.) **Samuel Cooper**, however, states that "in St. Bartholomew's Hospital, it once followed the operation of removing the breast." (p. 1230.) After amputation it has also occasionally occurred, and the melancholy death of the late Earl of **Darnley** was from tetanus consequent on having accidentally chopped off two of his toes with an axe.]

(*a*) Above cited.

[376* The *diagnosis* of tetanus from hydrophobia especially has been well given by J. L. Bardsley. In tetanus the stiffness and immobility of the lower jaw is present, and scarcely to be overcome by any effort during almost the entire course of the disease; in hydrophobia the spasms are always *clonic*, *i.e.*, always of brief duration, and succeeded by a period of complete relaxation, generally of many hours' duration, in the beginning of the disease, unless provoked by attempts to swallow. In very rare forms of tetanus, however, guttural spasms on attempting to drink, dread of fluids and their rejection when introduced, do occur. In tetanus there is rarely a discharge of saliva, which is a very marked symptom of hydrophobia, and thirst is as rare in the former as it is common in the latter. In tetanus the mind is almost always clear to the last; in hydrophobia, almost from the beginning, numberless deviations from the usual habits of thought and action indicate an incipient stage of mental aberration, which often passes on to delirium or raging madness. The countenance in tetanus differs from that in hydrophobia by the natural character of the eye and the general appearance of suffering; whilst in the latter the eye is preternaturally bright and glistening, and the face often exhibits frightful convulsions. Tetanus scarcely ever presents the laborious panting respiration, the tremor of all the muscles, the intolerant sensibility of the surface and organs of sense, which occur in hydrophobia. Tetanus seems to occur almost any time after the injury, but hydrophobia chiefly from the thirtieth to the sixtieth day.

376** The *prognosis* is always extremely unfavourable in traumatic tetanus, and Dr. O. Beirne (*a*) states, that of two hundred cases which he saw not a single one recovered. Hennen says:—"I have never been fortunate enough to cure a case of acute symptomatic tetanus: in some instances of the chronic species I have effected or witnessed a cure."(p. 245.) It may be taken as a rule that the danger of the patient is in proportion to the acuteness of the symptoms; whilst the more chronic they become, the greater hope may be entertained. As far as my own opportunities of observation permit me to form an opinion, I should say, that cases which pass over the seventh day, in general terminate favourably. Two cases, under such circumstances, we have had in St. Thomas's Hospital during the last twelve or fourteen months. When the disease also is simple trismus the prognosis is more encouraging than when tetanus sets in.—J. F. S.]

377. In the *treatment* of tetanus, the remote causes must be specially attended to, and, if they be in the wound, as foreign bodies, torn or tied nerves, and so on, they must be removed by enlarging the wound, or by some other way according to the rules of art. With this object is also the cauterization of the wound, and even the amputation of the limb itself, to be proposed (Larrey) (*b*).

Dupuytren (*c*) considers amputation in confirmed tetanus as useless.

378. For the further treatment a vast number of remedies have been proposed, more especially besides the antispasmodic means, opium in large doses, (when it cannot be introduced by the mouth, it may be by clysters, or even by injection of small doses of the watery extract of opium into the crural or median vein, musk, camphor, tincture of cantharides, laurel water, prussic acid (1), tobacco, oil of turpentine, arsenic, colchicum (*d*), and the like. Stutz recommends the alternate internal and external use

(*a*) Dublin Hospital Reports, vol. iii.

(*b*) Above cited, vol. i. p. 271.

(*c*) Leçons Orales de Clinique Chirurgicale, vol. ii. p. 611

(*d*) Percy and Laurent; in Dictionnaire des Sciences Médicales, vol. xxv. p. 31.

of opium, and of vegetable potash; besides also, bark, naphtha, and other stimulating or strengthening remedies, the use of the cold and warm bath. General blood-lettings, and in large quantity, are recommended by many, the internal and external use of mercury till salivation commences, cauteries in the nape of the neck and in the neighbourhood of the spine.

(1) **Klein** (*a*) first employed prussic acid in tetanus, but without result; he gave as much as 180 drops of **Ittner's** prussic acid in the four-and-twenty hours, and only observed it produce an easier death. **Trezwart** (Medical Recorder, 1825, Oct.) in one case, in which indeed very many untoward circumstances operated together, injected into the skin up to four drops in a short space of time, (twenty drops of the acid being diluted in three ounces of water,) and after each time he noticed a cessation of the cramp, although death ensued.

Smith (*b*) recommends colchicum, from sixteen successful cases, nine of which were traumatic tetanus, which he observed in Hayti. After having removed the costiveness by softening clysters and castor oil, he applied leeches or the cupping-glass along the whole length of the spine, and then laid compresses dipped in a strong solution of muriate of ammonia along the whole spine. He gave half a drachm of the vinous tincture of colchicum, increasing it every half hour till vomiting or purging took place, upon which the remedy was discontinued. If colic and faintness came on, he gave afterwards *liq. ammon. acet.* ℥ss., *morph. acet.* gr.ss.; in symptoms of collapse he put aside the narcotic, and applied warm poultices to the limbs.

[Some years ago I was shown by a West Indian friend the report, in some Jamaica medical journal, (perhaps that in which **Smith's** paper is, though, unfortunately, I cannot recollect it,) of a case of traumatic tetanus which was successfully treated by making long and deep incisions on either side of the ridge of the spine, from which free bleeding ensued, and afterwards the wounds were freely cauterized with caustic potash. Severe as this practice may seem to be, I am disposed to think it more likely to be successful than any other, if it be admitted that the spinal marrow reflects upon the general system, the irritation which has been set upon it by the local injury.—J. F. S.]

379. Neither of the preceding modes of treatment have yet been determined by general experience. The selection and union of the remedies must be determined according to the peculiarity of the case, according to the continued or speedy course of the disease, the constitution of the patient, the severity of the symptoms, and the condition of the wound. Experience is most in favour of blood-letting, of the internal use of calomel with opium or morphia, mercurial friction and warm bathing. Blood-letting is specially applicable to young country persons, at the beginning of the disease, in violent tension of the muscles, very red countenance, great dread of light, small pupil, but particularly when accompanied with inflammatory fever or any local inflammation. Cupping also along the spine may be used. In congestion of blood, in any organ, from severe contraction, the application of leeches may be needful; also about the wound, if very painful and inflamed, and, at the same time, an anodyne plaster may be put on. Only at the onset may the cold bath be used to subdue the disease commencing in the nervous system: at a later period the warm bath is preferable; the decided relief which is thereby produced is, however, only transitory. If a congestive condition, or erythysm, rather resemble in its course and symptoms tetanus, antispasmodic means, as opium, with camphor, musk, **Stutz's** treatment, prussic acid, must be employed, either with or immediately after antiphlogistic treatment. If there be shivering, the opium must be given in form of a diaphoretic.

Opium must be employed in largely increasing doses. No narcotism occurs even when eight, ten, and even twenty grains have been given every two hours. The consequent costiveness must be overcome by clysters composed of infusion of senna with sulphate of magnesia.

(*a*) Heidelberger klinische Annalen. (*b*) Jamaica Physical Journal.

[I must confess that the cases of cure of this disease, related as having followed any one plan of treatment, are by no means satisfactory. I have seen opium, tobacco, bleeding, mercury to salivation, and other remedies employed, and also have known of a case or two left without treatment, and the results in all cases the same,—fatal. In the extremely few cases which have recovered with one treatment or other, I therefore presume that nature has had more to do with it than the doctor, as she has when the cases have been left alone and recovered. At present our treatment of tetanus is completely empirical and has entirely failed; the only rule upon which we act being to repeat the same plan in the second under which the first case has recovered or been relieved; or, if the treatment have been unsuccessful, to adopt some other practice for the next case. One mode of proceeding, however, must be deprecated, viz., that of plunging the patient into a cold bath, which I once witnessed during my apprenticeship; the result was, that the patient was almost immediately lifted out—dead.—J. F. S.]

SECOND CHAPTER.—ON WOUNDS IN PARTICULAR.

I.—OF WOUNDS OF THE HEAD.

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380. *Wounds of the Head* (*Vulnera Capitis*) are among the most difficult and most important objects of Surgery. Their great importance depends

on the injury of the brain, which either occurs at the same time as the wound itself, or comes on afterwards. They must therefore be considered under a double point of view, in so far as *the various coverings of the brain are injured, or diseased affections of the organ itself are thereby produced.* In the former view are distinguished, 1. *Injuries of the soft parts upon the skull; 2. of the skull itself; 3. of the membranes, and of the brain itself.* The diseased conditions which they produce in the brain itself are, 1. *Concussion; 2. Inflammation; 3. Compression of the brain.*

381. All kinds of injuries may occur in the soft parts upon the skull: they may either simply penetrate through the skin, through the aponeurotic covering, through the frontal, temporal, and occipital muscles, or into the pericranium. Incised wounds require union, according to the ordinary rules, which, after the hair in the immediate neighbourhood has been shaved off, may be effected by sticking plaster and a proper bandage. Bleeding from the temporal, frontal, or occipital artery, may be stanched either by the proper union of the wound and compression of the artery against the bone, or more certainly by tying the vessel. The healing soon follows, under proper treatment. From improper and especially from irritating treatment, from the unsatisfactory condition of the patient, from catching cold, and so on, especially in persons of a bilious constitution, a considerable swelling not unfrequently arises in wounds penetrating only the scalp, which spreads over the whole head and face, the ears and eyelids; it is not very tender to the touch, retains the impress of the finger, its yellowish red colour, as in erysipelas, fades on pressure with the finger, but soon returns, and is connected with fever, headache, disposition to vomit, irritation of the brain, delirium, and coma. These symptoms are, under proper treatment, generally not dangerous, the wound looks well; blood-letting and gentle purging, with simple treatment of the wound, avoiding all irritation, in general speedily remove them, and the skin scales off.

382. If the *aponeurosis* of the skull and the *pericranium* be injured, there frequently arises, particularly in stabs, from inflammation of these fibrous structures, an elastic, reddish swelling, painful to the touch, generally less extensive than in the former case, but always connected in its aftercourse with extensive erysipelas, with a doughy state of the integument, with severe headache, fever, loss of sleep, and delirium. Suppuration, with destruction of the cellular tissue, quickly ensues, in which case, if the pericranium be attacked, it separates to a great extent from the skull, and the inflammation may be propagated to the *dura mater.* In this case, both general and local blood-letting, with purgatives and cold application, to the head, must be simultaneously applied. The most certain modes however, of preventing all dangerous symptoms, or of setting them aside, is to make cuts very early into the swelling, for the purpose of discharging the collected fluid and the dead cellular tissue. Warm applications and poultices may here also be employed very advantageously.

383. *Flap Wounds of the Coverings of the Skull*, even when a considerable portion of the bone is laid bare, must always, after careful cleansing of the flaps, be closely brought together with sticking plaster and with some stitches (1). Charpie and a compress are to be laid upon the flaps, and their connexion assisted with a suitable head-bandage. In most cases the flaps unite completely, but many only in part. If suppuration take place, a proper outlet must be provided for the pus; if a fluctuating swelling form, it must be opened at once, and the union of the flaps assisted by proper

bandaging. The bone but rarely exfoliates, and this mostly depends on improper treatment. If the flaps will not hold together because the deeper-lying parts are injured, and if the bone be discoloured, and other indications for trepanning be present, then we must endeavour to preserve the flaps till this take place.

[(1) Sutures in wounds of the scalp should never be used. They are never needed, for nineteen times out of twenty the flap will continue quietly in place after having been arranged; and, if not, a single strap or two of adhesive plaster will be amply sufficient. Sutures more frequently cause erysipelas than otherwise, and that they do so is proved by the erysipelas subsiding on their removal.—J. F. S.]

384. *Bruises of the Coverings of the Skull* produce swellings, the so-called *bumps* (1), (*Beule*, Germ.; *Bosses*, Fr.), which are sometimes more, sometimes less tense, often very painful, often distinctly fluctuating, even pulsating, often surrounded with a hard edge, according as the scalp, the aponeurosis, or the pericranium have suffered from the bruise, and blood has been poured out beneath them. Slight bumps usually disappear with cold applications, moderate pressure, and suitable antiphlogistic treatment. But if the bump be of large extent, distinctly fluctuating, or very painful, and much stretched, if there be effused blood beneath the aponeurosis, or the pericranium itself, it must be sufficiently opened with a cut, and the blood let out.

After bruising of the coverings of the skull, there often arise, after a considerable time, fluctuating swellings from which, when opened, fluid blood escapes, and in spite of a proper bandage again fill with blood. I know a case in which such a swelling of large size was punctured twelve and another three times before it completely subsided.

[(1) The word "bump" I must admit sounds oddly in surgery, but it fully implies what the author means; and it has been so rendered in the French translation by Pigné. The word "boils" is the usual meaning of "beule," but does not point out what is here intended, neither would the more euphonous word, "swellings."—J. F. S]

385. In *Injuries of the Bones of the Skull* are distinguished, contusions, cuts, clefts, and fractures without depression. The coverings of the skull may be therewith in various ways injured, or they may be unhurt.

386. *Bruises of the Skull*, which may be caused by any blunt instrument, or by a cut, or shot-wound, affect either only the outer plate of the bone, or the *diploe* and internal plate. In severe contusions of the skull, those vessels which connect the *dura mater* with the skull may be torn, and an extravasation of blood take place between the skull and the *dura mater*; or the connecting vessels of the *pericranium* and *dura mater* may be so hurt, that these may inflame and suppurate. If beside the bruising of the skull, no neighbouring mischief be present, the patient often, at first, feels but slight pain at the bruised part. After several days, the pain spreads over the head, the patient becomes excited, but is bodily depressed, there is nausea, disposition to vomit, loss of sleep; the pulse becomes quick and hard. Some days after the appearance of these symptoms, if the inflammation be not removed, a swelling not very painful usually occurs on the bruised part, on cutting into which, the *pericranium* is found separated and blackish, ichorous fluid is collected beneath it, and the bone is discoloured. In the aftercourse of the disease the fever becomes greater, the patient is more restless, the pulse quicker; shiverings, cold sweats, convulsions, delirium, coma, and death ensue. If there be an external wound, the condition of the pus changes under these circumstances; it becomes sanious, the wound is pale and flabby, and the *pericranium* separates from the bone. On examination after death, the *dura mater* is found

separated from the bone, there are collections of ichorous fluid, the *dura mater* is spoiled; frequently also between the *dura* and *pia mater* there are collections of pus.

[The not very painful swelling which occurs on the bruised part of the scalp, is held by POTT to be the diagnostic mark of pus, either forming or formed between the *dura mater* and the skull. He says:—" If the symptoms of pressure, such as stupidity, loss of sense, voluntary motion, &c., appear some few days after the head has suffered injury from external mischief, they do most probably imply an effusion of a fluid somewhere. This effusion may be in the substance of the brain, in its ventricles, between its membranes, or on the surface of the *dura mater*; and which of these is the real situation of such extravasation is a matter of great uncertainty, none of them being attended with any peculiar mark or sign that can be depended upon as pointing it out precisely; but the inflammation of the *dura mater* and the formation of matter between it and the skull, in consequence of contusion, is generally indicated and preceded by one which *I have hardly ever known to fail*; I mean a puffy, circumscribed, indolent tumor of the scalp, and a spontaneous separation of the *pericranium* from the skull under such tumor. These appearances therefore following a smart blow on the head, and attended with languor, pain, restlessness, watching, quick pulse, headache, and slight, irregular shiverings, do *almost infallibly* indicate an inflamed *dura mater*, and pus either forming or formed between it and the *cranium*. By detachment of the pericranium, I do not mean every separation of it from the bone which it should cover: it may be and often is cut, torn, or scraped off without any such consequence; but these separations are violent, whereas that which I mean is *spontaneous*, and is produced by the destruction of those vessels by which it was connected with the skull, and by which the communication between it and the internal part was carried on; and therefore it is to be observed that it is not the mere removal of that membrane which causes the bad symptoms, but it is the inflammation of the *dura mater*, of which inflammation this spontaneous secession of the pericranium is an almost certain indication." (p. 52–55.)

DEASE does not agree with POTT in attributing almost entirely to the inflammation and suppuration of the *dura mater* the many threatening symptoms resulting from " the injury which the different series of vessels that connect the *pericranium* and *dura mater* to the skull, sustain in wounds of the head where the cranium has suffered either contusion or division of its external table. * * * I should look upon it as a very fortunate circumstance in the patient's favour," says he, " did the mischief extend no farther, as it would put it more immediately in the surgeon's power to obviate the danger by having recourse to the trepan, an operation which we would by no means find so ineffectual in relieving the patient as we but too often experience it to be when this is not the case. I am very far from thinking that the inflammation or suppuration of any part of the *dura mater*, let it be ever so circumscribed, is not an alarming circumstance, and which of itself is capable of destroying the patient; but from what I have seen it is ever in the surgeon's power, by the application of the trepan, to rescue his patient from this danger, provided no other part of more importance be engaged." (pp. 46, 47.) He then proceeds to show that from " the injury of the outward vessels " there is no such great fear of affection of the *dura mater*, of its detachment and suppuration, by reference to the results of opening " fontenels (issues) by the actual cautery over the sutures, and that on account of the free communication which exists between the exterior vessels and those of the *dura mater*," and keeping them open for years, and asks, " have we a single instance of those issues being productive of an inflammation or suppuration of the *dura mater*? Although it evidently appears there must be a total destruction of all those exterior communicating vessels, and that in subjects it may be well supposed of no good habit of body." Again he asks:—" Does not the caries in those (venereal diseases of the skull) and scorbutic, and even cancerous cases, often extend to both tables, where the bones become so perforated with small holes that we can perceive the pulsation of the *dura mater* pumping the most acrid matter through them? How long do we see those unfortunate patients hold out in this miserable situation, and when they die do we in general impute their death to this as a local complaint, or rather to a broken-down constitution, perhaps exhausted by medicine, and still infected by the pocky virus? * * * Does the inflammation of this membrane, caused by the venereal virus or cancerous virus," he continues, " run less high previous to its producing a fetid sanies than that which precedes a laudable suppuration succeeding the obstruction or destruction of the vessels that pass between the *pericranium* and *dura mater* in consequence of contusions or simple fracture?" In this point of view we cannot certainly, with any degree of propriety, consider the putrefaction or inflammation of the *dura mater* in those cases to be so immediately the cause of death, and must have recourse to some more powerful one. All those wounds are to be considered more or less dangerous in proportion to the degree of concussion the brain or its meninges are supposed to receive. The *dura mater* being a strong ligamentous membrane, and firmly attached to the skull seems not to be so easily affected, being a fitter medium to transmit any shock it receives to the brain, than oppose it. The subsequent reasons will convince us, the *pia mater* and brain are the parts that most frequently suffer in those cases." (p. 46–53, *pass.*)

The following excellent observations of Dease, in reference to those cases in which "the cranium wa[illegible]id bare, contused, or its tables simply divided," will be fully assented to by such as have had many opportunities of witnessing these accidents. "If the instrument with which the blow was given was not heavy, nor the force very great, the patient, after a few minutes, perceives no complaint more than ought to be expected from a simple wound. If he be attended, it is seldom the surgeon will be able to determine, the first days, whether any farther injury has taken place or not. The wound digests as kindly, and the patient performs all the functions necessary to health as well as before he received it. Now in such as became afterwards affected, whether they underwent profuse evacuations, or were entirely left to nature, it made so very little difference, as to the time or manner, in which they were first invaded by the symptoms that usually attend an inflamed or suppurated state of the parts underneath the *cranium*, that I could never attribute the variation to the treatment. The first symptoms that generally alarmed those patients that came to the hospital, were slight shiverings, attended with an inclination to puke. In some this was preceded by a languor over them, accompanied with more or less degree of fever, and often with a dull pain in the head and melancholy look. The wound in some put on the appearance Mr. Pott describes; but this was by means constant, nor that infallible sign of the inflammation and putrefaction of the *dura mater* that he makes it. Nor did this appearance often take place until the fever and other symptoms were far advanced. In some those symptoms made a rapid progress, so as to carry off the patient in a few days. In others they seemed to advance more slowly, and were less severe, although not less fatal. I have seldom seen them appear earlier than the eighth day, or later than the sixteenth or seventeenth; between the eighth and the sixteenth being in general the period most to be dreaded. If the trepan was applied at any time after those symptoms took place, the appearance of the *dura mater* was invariably this: either it was detached and in a state of suppuration and sloughy, or sound in every respect. If the injury was confined to it, the operation, as far as I have seen, proved successful; and if the patient died, I have ever found the cause of his death in the suppuration of the *pia mater* or brain, but more generally in both." (p. 59–62.)

Guthrie justly observes:—"When the *periosteum* covering the bone is bruised, or the bone is deprived of this membrane, it does not follow that the bone should die or exfoliate. In many instances the wound will gradually close up and heal, as if no such accident had happened; and in most cases this termination will only be delayed by the separation of a scale of bone from its outer surface. If the bone should be bruised in addition, or slightly fractured, or depressed without a wound of the integuments, and the general treatment has not been strictly attended to, the case may terminate in one of those secondary tumors of the scalp which Dease and Pott have so admirably described, and which may be considered as a complaint fraught with the utmost danger." (pp. 120, 21.) The expressions "primary" and "secondary tumours," are Guthrie's own, the former applied to the bumps mentioned, (*par.* 384,) and the latter to the swelling especially treated of in the paragraph now considered. He also speaks of the distinguishing characters of the two swellings, perhaps more positively than observation will fully justify, but still they are worthy of observation:—"The essential difference between the primary and the secondary swelling is to be found in this circumstance, that although the bone may be exposed, and even in some degree have changed its colour in the primary swelling, when matter has formed, the febrile symptoms will subside after its evacuation, healthy granulations will spring up, and little or no exfoliation will take place; whilst in the secondary swelling none of these favourable symptoms or appearances will take place, for the bone is incapable of maintaining its life, it must separate, or be removed in part, if the outer table only be diseased, and by the operations of nature; but this must be done by the trephine, if there be reason to believe that matter has collected beneath, which must, I am of opinion, certainly take place, unless there should be a fissure or fracture through which it may escape." (p. 122.)]

387. A strict antiphlogistic *treatment*, blood-letting, leeches, cold fomentations, and antiphlogistic purges, in most cases, prevent the evil

results of these bruises (1). But if it be impossible to arrest the symptoms of inflammation, and proper antiphlogistic treatment do not prevent the passage of the inflammation into exudation and suppuration within the skull, a circumscribed swelling is formed, the pericranium separates, the exposed bone has a grayish colour, and its texture is changed, symptoms of pressure on the brain ensue, and trepanning is indicated (2). If the suppuration and exudation be confined to one particular part between [illegible] skull and the *dura mater*, the operation may be serviceable (3). But most commonly, in simultaneous diffusion of the exudation over the whole surface of the brain, nothing can prevent the fatal termination.

[(1) I prefer poultices in bruises of the scalp, as well as in other parts, to cold applications; but in military surgery the use of cold lotions is especially recommended by GUTHRIE and HENNEN.

Directly there is any appearance of a disposition to inflammation of the *dura mater*, and if there be tenderness and puffiness of the scalp, free cuts down to the bone should be immediately made in the latter, and calomel administered internally till the gums are tender. Under this treatment the symptoms subside. The determination to trepan the skull, as proposed by CHELIUS, is not a matter of so slight import as he seems to think; for it is very difficult, indeed impossible, to decide on the special point of the effusion; and as frequently as not, the effusion is beneath the *dura mater*, instead of above it. I recollect having once witnessed an improvement upon trepanning in a case of this sort, in which the surgeon bored half a score gimblet-holes through the skull; the pus happened to be between the bone and the *dura mater*, and readily escaped, but the patient died.—J. F. S.

(2) The following are the rules and reasons laid down by DEASE for applying the trephine in these cases:—"After making use of such evacuations, &c., on the first appearance of the symptoms, as the surgeon shall think proper, if he finds they are not mitigated, or although they should for two or three, or even more days, if they return, and the patient grows every hour visibly worse, I think the trepan should not be deferred. 1st, Because we cannot tell but the disease is confined to the detachment of the *dura mater* and its suppuration, and the brain may not be injured; so that, in this case, the patient will be relieved by the operation. 2d, As there are no visible means left but the operation to relieve the patient, to give him ever so small a chance will be better than leaving him to certain death." (p. 96).

(3) In reference to the existence of pus beneath the *dura mater*, GUTHRIE makes the following very important observations. "I have seen," says he, "on the removal of a portion of bone by the trephine, the *dura mater* rapidly rise up into the opening, so as to attain nearly the level of the surface of the skull, totally devoid, however, of that pulsatory motion which usually marks its healthy state; and an opening into it, under these circumstances, has allowed a quantity of purulent matter to escape, proving that the unnatural elevation of the *dura mater* was caused by the resiliency of the brain, when the opposing pressure of the *cranium* was removed. I consider this tense elevation and the absence of pulsation to be positive signs of there being a fluid beneath, requiring an incision into the *dura mater* for its evacuation. It is a point scarcely at all noticed in English surgery, although much insisted upon in France." (p. 125).

In regard to puncturing the *dura mater*, when no pus is found between it and the skull, DEASE observes:—"As the injury is seldom confined to the *dura mater*, the *pia mater* being too often the seat of suppuration, it may be thought an advisable means to open the first the membrane, if by the trepan no relief has been procured the patient. Although in such a desperate case, any attempt that even bore the possibility of succeeding should be embraced; yet this will prove in general, from all I have ever seen, ineffectual; and for this reason,—the matter is seldom or ever collected in one place, but generally diffused over one or both hemispheres of the brain, or part of them; and although it should be immediately under the perforation, we cannot consider the fine *pia mater* by any means equal to form such a cyst as might limit or circumscribe it, as we see the cellular membrane does in external inflammations that suppurate. However, as opening this membrane, in those desperate circumstances, cannot add to the danger, a small one may be made with a lancet, which afterwards, if it be thought necessary, or of any advantage to the patient, may be enlarged. I have recommended a small incision on this account, that the crucial one as is ordered in most of our treatises on operations, is attended with the disagreeable circumstance of the brain's protruding." (pp. 76, 7.)]

388. *Cuts of the Skull* have either a vertical or an oblique direction, by which a piece of the bone may be perfectly cut off, or still hanging in the flaps of the soft parts. These wounds are either simply superficial, or penetrate into the *diploë*, or even into the cavity of the skull, and are produced with either a *sharp* or a *blunt* instrument.

["It is worthy of remark," says HENNEN, "that the sabre wounds on the top of the head are not by any means so dangerous as those on the sides; this I have often had occasion to observe in my own practice, as well as from the report of others. In some sabre wounds which divide the skull across the sagittal suture, the longitudinal sinus has been occasionally opened and bled profusely, but without inducing fatal consequences. I have seen this sinus opened by splinters, but never saw any thing approaching to dangerous hæmorrhage from it; in truth, the bleeding from wounds of the head is one principal source of the patient's safety." (pp. 283, 84.)

THOMSON observes, that "in the cases in which the sabre had struck the head perpendicularly, the effects which it produced were exceedingly diversified. In some cases the external table of the *cranium* was divided, the internal remaining uninjured. In a Frenchman who had received twenty sabre cuts in different parts of the body, and who died from the symptomatic fever appearing to arise from the high degree of inflammation attendant upon a wound of the elbow-joint, there were found, on examination after death, not fewer than thirteen cuts of the upper part of the *cranium*, penetrating only its external table, without any inflammation having been communicated to the brain and its membranes. In other cases both tables were divided, and the edges of the internal turned in upon the brain and its membranes. In almost all these cases exfoliations of a greater or smaller extent were taking place, and retarding the completion of the cure." (pp. 51, 2.)]

389. *Superficial Wounds caused by a sharp instrument*, penetrating to the *diploë*, or through the internal table of the skull, without splitting and much bruising of the skull, if the internal parts be uninjured, and no signs of extravasation present, require quick union, strict antiphlogistic treatment, and continued use of cooling applications. If suppuration take place, the proper discharge of the pus must be attended to, and the wound bound up with soothing remedies. But if the wound be made with a *blunt* sword, and accompanied with splintering of the bone, the splinters driven in, piercing the *dura mater*, and not to be removed by the existing wound; or if there be also decided symptoms of extravasation within the skull, and the edges of the bone be not so far asunder that the extravasation and secretion from the wound escape freely, immediate trepanning is required. If a piece of bone completely cut off, still hang to a flap of the soft parts, the latter may be laid down, if there be no splintering, with the piece of bone, and union attempted by stitches, sticking plaster, and a suitable bandage: the possibility of the union of such pieces of bone is proved by experience. But if the flaps be already swollen, or the piece of bone cannot, as in most cases, be closely applied, it is advisable to remove it, and then to unite the flap.

[HENNEN mentions that in some sabre cuts "inflicted by our own and the French dragoons in Spain and Belgium, sections of the scalp, *cranium*, and even of the brain, were frequently made, and in many instances were successfully treated by simply laying the parts together." (p. 282.) And the same may also happen in the more severe and irregular fractures produced by balls, of which he mentions a preparation, where "a large part of the frontal bone, nearly four inches in circumference, including the superciliary ridge and subjacent frontal sinus, is carried outward and overlaps the temporal fossa: the bony union is nearly complete; while a musket ball is lodged deep in the anterior lobe of the brain. The man died two months after the accident." (p. 295.) The union of such slices of the skull is by no means uncommon, as almost every pathological museum amply proves.—J. F. S.

Upon this subject THOMSON observes:—"In some of the wounds in which the head had been struck obliquely by the sabre, portions of the *cranium* had been removed without the brain appearing to have sustained much injury. In one case of this kind, where a considerable portion of the upper part of the occipital bone along with the *dura mater* had been removed, a tendency to protrusion of the brain took place during an attack of inflammation; a slight degree of stupor, with loss of memory occurred: but on the inflammatory state having been subdued, the brain sunk to its former level, the stupor went off, and the memory returned. It seems probable that when the brain protrudes in cases of this kind, a disposition to the formation of fungus may be given; but in the instances which I have seen this protrusion occur, it has appeared to me to proceed from causes very different from those by which fungus is usually produced. We had frequent opportunities of seeing the upper and the lateral parts of the *cerebrum* exposed by sabre wounds; but in no case, except that which I have mentioned, did any tendency to protrusion of the brain present itself to our notice. In a remarkable sabre cut in the nape of the neck of a Frenchman in the Corderie, more than an inch in breadth of the inferior part of the left lobe of the *cerebellum* had been exposed, and was seen pulsating for a period of eight weeks, without any tendency to protrusion having taken place. This exposure was unaccompanied by any particular constitutional affection; but, like several others who had received deep cuts on the back part of the neck, this man complained of great feebleness in the lower extremities." (pp. 50, 1.)]

390. *Fractures of the Skull* (*Fracturæ Cranii*) vary, according as the separation of the bones is slight or the edges are wider apart; in the former case they are called *Clefts* or *Fissures* (*Fissuræ.*) These may penetrate either only through the external table, or also through the inner; or the inner table alone may have sprung off. Their direction is various; straight, jagged, or sometimes both at once, and so on. They occur either at the place where the external violence has acted, or far from it, and are then called *Counter-Clefts* (*Contra-Fissuræ*) and *Counter-Fractures* (*Contra-Fracturæ.*) The more brittle and fragile are the bones of the skull, the more readily do fractures occur, and because the thickness of the bones is unequal at different parts, counter-fractures are produced. Fracture of the inner table happens only at those parts where the two tables are separated by *diploë*, and where the external is thicker than the internal. Fractures of the skull occur the more easily as the bones are thinner and more compact, and have less *diploë*; they are, therefore, most common in old, and less frequent in young persons.

[It may be observed, that no symptoms are here mentioned as indicating the existence of fissure or fracture of the skull, nor indeed are any produced from such injuries. Upon this point POTT well observes:—"The symptoms just mentioned (vomiting, giddiness, loss of sense, speech, and voluntary motion, bleeding at the ears, nose, mouth, &c.) do very frequently accompany a broken skull; but they are not produced by the breach made in the bone, nor do they indicate such breach to have been made. They proceed from an affection of the brain, or from injury done to some of the parts within the *cranium*, independent of any ill which the bones composing it may have sustained. They are occasioned by violence offered to the contents of the head in general; are quite independent of the mere breach made in the bone; and either do or do not accompany fracture, as such fracture may happen to be or not to be complicated with such other ills. They are frequently produced by extravasations of blood or serum, upon or between the membranes of the brain, or by shocks or concussions of its substance, in cases where the skull is perfectly intire and unhurt. On the other hand, the bones of the skull are sometimes cracked, broken, nay, even depressed, and the patient suffers none of these symptoms. In short, as the breach made in the bone is not, nor can be, the cause of such complaints, they ought not to be attributed to it, and that for reasons which are by no means merely speculative." (pp. 132, 33.)]

391. If in fracture of the skull, its coverings be not injured, and the edges of the fracture be not separated, the fracture cannot be discovered by the touch; it frequently can only, with more or less probability, be presumed, according to the violence with which the force has operated.

If there be a wound and the bone be bared, the cleft is distinguishable, as most commonly blood oozes out of it, when it has been sponged, which distinguishes it from the natural grooves in the bones of the skull; also if the *pericranium* over the cleft and fracture be separated, the irregularities may be perceived with the finger and with the probe, and with a very thin probe the depth of the fracture may be measured. Bleeding from the nose, mouth, and ears, are not always decided signs of fracture of the skull (1). A knowledge of counter-fractures is quite uncertain; only when extensive can they, perhaps, be traced through the external coverings, or if these be changed in appearance, they may be suspected (2).

[(1) Bleeding from the ears, in injury of the head, is of not unfrequent occurrence, and although generally accompanying fracture through the base of the skull, is not always present; and when it occurs, it is not to be considered as a decided mark of that fracture; at least a patient may recover, with few or without any symptoms of injury to the head, when it takes place even to the extent of a pint of blood; an instance of which I have had under my care within the last three or four years. It is, however, a symptom not to be thought little of, as it so frequently accompanies serious mischief. Bleeding from the mouth, in fractured base of the skull, is rare; I have not seen it above two or three times.

(2) I am not aware of a single instance in which it could be certainly determined prior to death that a fissure at the base existed; but I have known frequent examples of its presumed existence being disproved on examination of the head after death, as well as many in which it was found when not anticipated.—J. F. S.]

392. Every fracture of the skull proves that it has suffered severe violence. The external appearance of injury to the bone is not always proportionate to its danger; as, from the condition of the external wound of the bone, the internal state of the parts cannot be decided on. The peculiar brittleness and glass-like state of the internal table of the skull, is the cause of its not breaking in the direction and to the extent of the external fracture, but that the fracture always radiates, that it most commonly splits, and that the *dura mater* is thereby more or less separated and injured. The violence most commonly causes bruising of the *diploë*, and other changes in the interior of the skull. On these grounds, it is held that in most cases, clefts and fractures of the skull may produce, either at once or at a shorter or longer period after the injury, irritation of the membranes of the brain, and of the brain itself, extravasation of blood or pus, and destruction of the bone; and that, therefore, *fractures of the skull* and *penetrating clefts* require trepanning, although no symptoms of pressure or of irritation of the brain be present. If clefts and fractures of the skull be considered as conditions free from danger, and if trepanning be restricted merely to those cases in which, with other accompanying injuries, symptoms of irritation and pressure of the brain occur at once, or come on later, so, in most cases, the result will be unsatisfactory if the trepanning be delayed till the consecutive symptoms have occurred, as the diseased changes within the skull will have already advanced to a considerable extent.

[GUTHRIE makes some very good remarks on fracture of the internal table of the skull, resulting from the blow of a sword, hatchet, or other clean-cutting instrument. "When the sword or axe" says he, "has penetrated as far as, or through the internal table, the case is of a much more serious nature, for this part will be broken almost always to a greater extent than the outer table, and will be separated from it and driven into the membranes, if not into the substance of the brain itself; the surface of the bone showing merely a separation of the edges of the cut made into it. These cases should be all carefully examined. The length of the wound on the top or side, or any part of the head which is curved and not flat, will readily show to what depth the sword or axe has penetrated. A blunt or flat-ended probe should in such cases be carefully passed into the wound, and being gently pressed against one of the cut edges of the bone, its thickness may be measured, and the presence or absence of the inner table may thus be ascertained. If it should be separated from the *diploë*, the continued but careful insertion of the probe will detect it deeper in the wound; a further careful investigation will show the extent in length of this separation, although not in width; and will in all probability satisfy the surgeon that those portions of bone which have thus been broken and driven in, are sticking in or irritating the brain. In many such cases there has not been more than a momentary stunning felt by the patient; he says he is free from symptoms, that he is not much hurt, and is satisfied he shall be well in a few days." (p. 86.)]

393. According to the result of close observation and experience, the dangers of clefts and fractures of the skull are in this respect exaggerated. They are very different, according to the degree of violence by which they are produced, according to the condition of the bones of the skull and the other injuries and affections of the brain which may be connected with them. They frequently occur as simple injuries of bone, without splintering or separation of the *dura mater*, without further and irregular radiation of the internal table, and they heal by simple treatment of the wound and strict antiphlogistic remedies, repeated blood-letting, purgatives, and cold applications. It is therefore not advisable, with the mere object of discovering some cleft or fracture of the skull, to cut into the soft parts, if no other circumstances require it. If the fracture of the skull be accompanied with much splintering, as in starred fractures and so on, and the splinters which irritate and injure the *dura mater* cannot be removed, or if symptoms of extravasation and pressure of the brain be present, and the edges of the bone be so close that the extravasation cannot escape, then trepanning is requisite.

[CHELIUS's views on this important point are extremely correct; it is quite time enough to make cuts through the scalp and trephine the skull when symptoms have occurred: it should never be thought of otherwise. The less done as regards meddling with fractures of the skull, the better; they never should be interfered with except compression be present.—J. F. S.]

394. If in fracture of the skull one edge of the bone sink inwards, it is called *Fracture of the Skull with impression* (*Fractura Cranii cum impressione.*) In indented skull-bones, especially in children, indentation is possible without fracture (1); just as in persons of middle age, the external table may be pressed into the *diploë* without fracture of the internal table (2). The indentation is always discoverable by the touch, and with careful examination can always be distinguished from the bump with a hard edge (3). Often a whole piece of the skull is broken off and depressed; often is there a starred fracture; often the external table is still whole, and the internal sprung.

Indentations of the skull are nearly always accompanied with severe injury of its coverings, with separation of the *dura mater*, injury of the vessels, and extravasation. The effects of indentation of the skull are symptoms of pressure on the brain, inflammation of the brain and its membranes. In rare cases, however, even severe indentations are at first unconnected with any bad symptoms; those of pressure and irritation come on at a later period.

[(1) The extent to which the skull may be indented in children, without symptoms of compression, is almost incredible. I remember a case under my friend GREEN some years ago, in which a child, about three or four years old, had the skull indented, near the upper part of the lambdoidal suture, so deeply that the bowl of a dessert spoon would easily lie in it. The child had no symptoms of pressure: little more was done than keeping it quiet and looking after its bowels; it never had a symptom; left the house perfectly well, but with the skull indented as at first.

(2) Astley Cooper speaks of a "curious fracture of the skull which occasionally happens over the frontal sinuses. When the fracture is simple, if the nose be blown, the air escapes through the opening in the bone into the cellular membrane under the skin, and renders the forehead emphysematous. If, on the other hand, the fracture be compound, upon blowing the nose the air rushes through the wound, so that, in either case the nature of the accident may be easily ascertained." (p. 296.) This is a very rare accident. I have only once seen an instance of a simple one, and in this the air made its way into the cellular tissue beneath the upper eyelids and closed them. No dangerous consequences followed the injury.

(3) Care must be taken, especially by young practitioners, in deciding on the existence of fracture with depression, when there is no external wound, as the depression is often only seeming and not real. Upon this point Astley Cooper observes:—"A person receives a blow on the scalp; the parts immediately surrounding the spot where the blow was received swell from the extravasation of blood; but at the part on which the blow directly fell, the cellular membrane, having been condensed by the injury, will not receive the extravasated blood; thus the surrounding parts are considerably higher than the middle." (p. 301.) The exact state of the case can, however, be ascertained without much difficulty, if the seeming depression originate from the cause just mentioned; firm pressure on the elevated part for a few minutes will diffuse the outpoured blood into the surrounding cellular tissue, and the apparent depression will disappear; but if there be actual depression, the pressure of course will not make any alteration in the hollow formed by the driving down of the bone.—J.F.S.]

395. Fractures with impression of the skull always require immediate trepanning, although unaccompanied with symptoms of pressure and irritation of the brain. These occur earlier or later, and then no benefit is derived from the operation The object of trepanning is to raise the inpressed bone, to remove the extravasation and the splinters of bone, and to prevent after-collections in the cavity of the skull. Trepanning is only superfluous when, from the condition of the wound, it is possible to remove carefully the splinters or completely broken-off pieces, and to let the extravasation escape. It may be hoped in children who have fracture with impression, that with proper antiphlogistic curative means, nature will accommodate the brain to the pressure, if the indent be not upon a blood sinus, in which case it must be at once trepanned.

[Chelius does not appear to make any difference in the treatment of simple fracture with depression, and of that which is compound or accompanied with wound of the scalp; but in both cases, whether symptoms of pressure on the brain do or do not exist, immediately proceeds to trephine, and removes the depressed bone. The cases, however, require different treatment if the fracture be simple, but if compound the same practice is proper for both. If the fracture be simple and unaccompanied with symptoms of pressure, no incision is to be made through the scalp upon it, and much less should it be trephined. Astley Cooper observes on this point:—"If the fracture be simple and there be no wound in the scalp, and no symptom of injury to the brain, it would be wrong to make an incision into the part, and perform the operation of trephining; for, by making such an incision, you add greatly to the danger of the patient, as you may make what was before a simple, a compound fracture, and consequently greatly increase the danger of inflammation, which rarely follows fracture with depression, where the fracture is simple, but is a very frequent consequence of a compound fracture, which is produced by making an incision in the scalp. Never make an incision therefore when you can avoid it, or merely because there is a fracture with depression, if there be no symptoms of injury to the brain. Even if there be symptoms of injury to the brain, and the fracture be simple, do not immediately trepan. Take away blood and purge your patient freely, and see how far the symptoms may be the result of concussion of the brain, and not of depression. If the symptoms do not yield to depletion, then, and not till then, perform the operation of trephining." (pp. 303, 304.)

Abernethy also holds the same opinion. "It appears very clearly," says he, "that a slight degree of pressure does not derange the functions of the brain for a limited time after its application. That it does not do so at first is very obvious, as persons are often perfectly sensible and free from headach and giddiness immediately after the injury. Whether it may not produce such an effect at some remote period, is not so easily determined, since this cannot be ascertained but by a continued acquaintance with the persons who had received the injuries. All, however, whom I have had an opportunity of knowing for any length of time after the accident continued as well as if nothing of the kind had ever happened to them. (p. 14.) Though a slight degree of pressure does not immediately affect the functions of the brain, yet it may act in another way; it may excite inflammation of that organ, as it does of other parts of the body. Its power in this respect, however, will probably lessen by the part becoming accustomed to it; and the cases on record, where fractures with depression have done well, as well as those of recovery from apoplexy, are proofs that the cause which in the first instance was injurious by its pressure may continue to exist without inconvenience. Such cases ought surely to deter surgeons from elevating the bone, in every instance of slight depression, since by the operation they must inflict a further injury upon their patients, the consequence of which it is impossible to estimate. From all therefore I have learned from books, as well as from the observations I have made in practice, and from reasoning upon the subject, I am disposed to join in opinion with those surgeons who are against trephining in slight depressions of the skull, or small extravasations on the *dura mater*. * * * A circumstance, however, frequently occurs that may render the surgeon doubtful as to what course he ought to pursue; this happens, when at the same time that the skull is slighly depressed, the patient labours under the effects of concussion. * * * As the effects of the latter gradually abate, a little delay will enable the surgeon to decide upon the nature of the mischief, and take his measures accordingly. Where the patient retains his faculties, nothing farther is necessary than a continuance of the antiphlogistic plan; and should any inflammation afterwards take place, the same means employed, in a degree proportioned to the urgency of the symptoms, will, in most instances, be successful, without elevating the bone." (p. 21–23.)

It must not, however, be forgotten, that, although to the teaching of these two great masters in Surgery, the almost universal practice, now pursued in this country, of not trephining simple fractures of the skull, with depression but without symptoms, must be ascribed, yet the practice did not originate with them: for Dease appears to me to have been the first, who, led by the result of his own observations, broke through the practice of trephining in cases of simple fracture of the skull, for fear of inflammation and suppuration of the *dura mater*, especially laid down by Pott, whose practice he for some time followed. In his *Introduction* he says:—"I considered those fatal consequences too often to proceed from the obstinacy of the patients in not submitting early to the necessary evacuations, and their general neglect of keeping to any low regimen; as the greater number by far of them were under no apprehension of danger, from a wound unattended by any other disagreeable circumstance, so that until they were seized with those symptoms which shewed the suppuration begun, they, for the most part, followed their usual employments. I determined, therefore, to persuade such as presented themselves, especially those who had wounds where the *cranium* was so injured as to make me apprehend the *dura mater* or its vessels suffered, as in those who had simple fractures, to come into the hospital, informing them of the bad consequences their not complying would be productive of. All those who fell under my care, in such circumstances, from the beginning, I treated in the manner I then thought most likely to prevent any future inflammation and suppuration taking place in the brain or its meninges; profuse bleeding, purging, severe regimen, &c., were not spared; and all those who had simple fractures were immediately trepanned. However, I can assure the reader, the event by no means answered my expectation; for, notwithstanding, fevers, shiverings, and all the concomitant symptoms of matter underneath the *cranium*, succeeded as frequently in ten, twelve, or fourteen days, and terminated as fatally as if they were entirely left to nature; and such as recovered I could by no means attribute to the treatment, as many in similar circumstances did well, without having the least alarming symptoms intervene, although they neglected all advice, and some lived very irregularly; and even in such as were after seized with symptoms they did not appear earlier or more severe, than in those who were treated with the most exact attention.

"From this I am induced to think that a surgeon who applies the trepan in simple fractures, where he has not a strong probability of the detachment of the *dura mater*, extravasation, &c., in order to obviate the consequences of its future inflammation and suppuration, subjects his patient to a severe operation, ever more or less dangerous in itself, often productive of disagreeable effects, which remain during life, and by no means indicated; and that the good effects of profuse bleeding, in disengaging the parts affected, are extremely doubtful." (p. xxii–xxvi.)

If, however, with simple depressed fracture, there be decided symptoms of pressure upon the brain, and so marked as to be incapable of confusing with concussion, then an operation for their relief should not be delayed.

When, on the other hand, the fracture is compound, whether symptoms of pressure be not or be present, the depressed bone must be at once raised or removed, according to circumstances; "because," says **Astley Cooper**, "a compound fracture is followed very generally by inflammation of the brain; and it will be of little use to trephine, when inflammation is once produced. It might be thought it would be time enough to perform this operation when inflammation had appeared; but this is not the case; for if the inflammation comes on, the patient will generally die, whether you trephine or not, and you will not arrest its fatal progress by trephining, but the operation will add to the danger of increasing the inflammation." (p. 305.)

Hennen, however, does not entirely agree with the necessity for trephining, even when there is depression with wound, and in those more severe cases where the injury has been consequent on gun-shot; and he mentions two very remarkable instances, in which neither was any operation for the removal of the depressed bone performed, nor did any symptoms of compression ensue. A soldier received a musket-ball on the 18th of June, on the right parietal bone close to the junction of the sagittal and lambdoidal sutures, which "fractured the bone to an extent corresponding with its own size. The ball was split into two portions, forming nearly right angles. It was easily removed, but from the narrowness of the passage, and from the depth to which the fractured portion of bone had been driven into the brain (being *exactly an inch and one-fourth* from the surface of the scalp) no operation was performed on the field; and as no one bad symptom occurred in the hospital, I did not allow the wound to be meddled with there. I trusted to venesection, a most rigid abstinence, open bowels, and mild easy dressings. On the 14th of July or 26th day, the wound was nearly closed without any one untoward symptom, and the functions were in every respect natural. In a few weeks after the man was discharged cured. In a similar case, where the man survived thirteen years, with no other inconvenience than occasional determination to the head on hard drinking, *a funnel-like depression to the depth of an inch-and-a-half* was formed in the vertex. I am in possession of several other instances of a similar kind. We have here sufficient proof that there is no absolute necessity for trepanning merely for depressed bones from gun-shot, although few would be so hardy as not to remove all fragments that came easily and readily away." (pp. 287, 288.)]

396. The sutures of the skull may by great violence be separated from each other. When this has been discovered by enlarging the wound or by proper incisions, and the separation of the sutures is not so great as to permit the ready escape of fluid from both sides, trepanning is indicated.

397. The severity of the violence which produces injury of the skull is an important point in determining on its danger, as in injuries caused by very great violence nearly always splintering of the bone, separation and injury of the *dura mater*, and so on, occur, which earlier or later produce dangerous symptoms; this is specially the case in gun-shot wounds. If in these wounds there be merely injury of the soft parts, laying bare the bone, or superficial injury without splintering, a simple but strict antiphlogistic treatment must be employed. But if they be connected with splitting of the bone, if they penetrate into the *diploë*, if the external table be torn off and the internal splintered, or if a piece of bone be impressed, then immediate trepanning is required.

["Fractures from gun-shot are almost universally of the compound kind," says **Hennen**, "and are rarely unaccompanied with great depression of the skull. The difficulties of elevating or extracting the depressed portions of bone beat in upon the brain by gun-shot, or the extraneous matter carried into its substance, are often very embarassing; the ball, from the projectile force communicated to it, not only fracturing the bone, but hurrying in with it the detached piece or pieces and jamming them under or among sound parts; frequently also it lodges among the fractured portions; frequently it imbeds itself between the more solid osseous plates, and forms a kind of nidus in the *diploë*; and sometimes it drives forward into the brain itself, eluding the search of the surgeon, and subverting the theories of the physiologist. In the majority of cases a leaden ball is either flattened against the bone, or, if it has struck obliquely, it is cut against the unshattered edge of the *cranium*, and is either simply jagged, or is divided into two or more distinct parts, forming with each other various angles, influenced in their acuteness by the projectile force, the distance, obliquity, &c., &c. It not unfrequently happens that a perfect division of the ball takes place, and the two distinct masses lodge, or one lodges and the other flies off, or else it takes its course through a different set of parts, or imbeds itself in a different spot from that where it originally struck. In all these cases, the removal of extraneous matters, the extraction of the fractured portions, if they lie loose, and the elevation of the depressions, where it can be done without the infliction of additional violence, are, of course, the first steps to be taken; but instances (particularly on the field) will occur, where this cannot be done. The grand and leading point to be kept in view, in all cases, is the great tendency of the brain and its membranes to inflammation, the uncertain period at which it may occur, and the very doubtful consequences which may succeed its occurrence. So irregular, however, and as it were so capricious is nature, that, whilst the slightest causes produce inflammation in its most violent and aggravated forms, extensive injuries, fracture, depression, and even permanent compression from lodgment of balls, have been followed by no such consequences." (pp. 285, 6.)]

Dr. CUNNINGHAM of Hailsham relates (*a*) the case of a lad of fourteen years, who, by the bursting of a pistol which he was firing, received its breech in his head. The wound was of a circular form, within three lines of the left superciliary ridge, and a corresponding piece of the frontal bone was driven, without fracturing beyond its edge, or injuring the surrounding integument. A table-spoonful of brain had escaped; he was bleeding profusely, and in a state of collapse. Careful probing could not reach any foreign body; he was therefore merely kept very quiet, and saturnine lotions applied to the forehead. On the following day slight bleeding continued; he had had a convulsion during the night. He lies perfectly quiet, says he is in *no pain*, but sleepy. An aperient was given, which freely moved his bowels. On the third day his pulse was not so compressible, but variable; the skin hot, and cheeks flushed, but otherwise much the same. Puts out his tongue when asked to do so, but answers no questions. The wound is filled with coagulum. Cold lead wash and bread poultice applied, and fever-mixture given. He was relieved of the feverish symptoms next day, and rather more sensible. In the course of a few days the clot was thrown off, and a free discharge of pus followed, which gradually lessened, and the wound appeared to heal as fast as possible. His strength seemed gradually returning; the pulse became more healthy; he answered questions, and could see around him very well. On being asked where he felt pain, he put his hand to the *back of his head*, but would not raise it up. This state continued to the twenty-second day, when he appeared rather suddenly to be sinking; on the following day he was perfectly comatose, and on the *twenty-fourth* after the accident he died. "On removing the upper part of the *cranium* the wound of the brain was found to have *perfectly healed*. The *dura mater* adhered all round the aperture in the skull, which had diminished to half its original size, so that at first I began to think my diagnosis had been incorrect; but when I reached the ventricles, I perceived the trace of a foreign body; a little further there was a good deal of disorganization from the formation of pus, and resting against the occipital bone and over the tentorium lay the breech of the pistol, an iron screw weighing *nine drachms*." (p. 559.) This is a very interesting case as shewing the facility with which a severe wound of the brain may be repaired, as well as the time which may be occupied by that process. Its result is that usually occurring at a more or less early period after the lodgment of foreign bodies in the skull.

I recollect ASTLEY COOPER used to mention, in his lectures on gun-shot wounds, an instance of the lodgment of a ball in the frontal sinuses of a nobleman who was shot in a duel. The ball was left, for what reason I do not remember, and it continued quiet for some months, after which it irritated the bone, which became carious, and gradually made its way through the nostrils, and through the bony palate into the mouth, and in making its escape wounded the palatine artery from which there was a free bleeding. I think the patient recovered.—J. F. S.

Another, and still more remarkable, instance of the lodgment of a foreign body in the frontal sinuses, which subsequently began to make its way out, is mentioned by Dr. O'CALLAGHAN (*b*). An officer in our Indian army received, by the bursting of his fowling-piece, on 22nd Jan. 1828, a circular wound, about an inch in diameter, above the nasal process of the frontal bone, the outer table of which was destroyed. He was knocked down by the blow, but rose immediately without assistance, and walked to a neighbouring cottage, where the wound continued bleeding for several hours, and produced faintness approaching to delirium. On the following day, the surrounding parts

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(*a*) Lancet, 1827–28, vol. ii.

(*b*) Dublin Medical Press, 1845, p. 82.

over the right eye were much swollen and tender; he had constant pain shooting through the forehead, and restlessness, so as to prevent his sleep; pulse 80; mental faculties unimpaired. On the 28th he was moved in a palanquin to Badulla. He recovered under the most simple treatment; but during the course of his cure there was a constant discharge of bloody serum mixed with pus from the wound; and pus with bits of bone passed from the nostrils. On 29th March he was conveyed to Colombo. Soon after he returned to his duty; but in the latter end of the year he was troubled with the protrusion of a metallic body through the palate, and a very offensive discharge, of which, however, he was not aware, having lost the sense of smell at the time of the accident. In May 1835, the metal had projected so far as to render attempts at its removal, by filing it off, feasible; but the endeavour to do so was productive of such excessive agony that it was not persisted in. He continued in much the same state, and died on 25th March of the following year, from imprudence in drinking. On examining the head after death, the whole of the iron breech of the gun, with the screw attached, weighing nearly three ounces, and its length two inches and three-quarters, were found lodged in the forehead. The anterior portion of the right hemisphere of the brain rested on the flat part of the breech, and separated from it only by a false membrane.]

398. What has been already said, in many respects applies to *Injuries of the Brain and its membranes.* The *dura mater* may be wounded or torn, either by the injuring instrument or by depression of the piece of bone, irritated, pressed, or inflamed by the blood poured out; or its connexion with the skull may be disturbed, in which case the vessels connected with it are torn; or it may be so injured by bruising that it inflames, suppurates, and so on. The brain may be variously damaged by the wounding instrument or by depressed bone; balls, or other foreign bodies, may remain lodged in it; and even entire parts of the brain may be bruised or lost. The consequences of concussion are also sometimes observed deep in the brain, as well as directly opposite where it has been struck, as proved by outpouring of blood and other signs at parts other than those which were struck. The mass of the brain may be thereby torn, or be pressed apart by the fluid poured out in the brain. These injuries are always extremely dangerous. The symptoms which either occur at once, or come on at a shorter or longer period, are those of commotion, of inflammation, or pressure of the brain.

[" Perforations of the bone, from bayonet thrusts, are rare and generally fatal," says Hennen, " but whenever the patient survives, their mechanical treatment will consist merely in extracting spicula of bone, and elevating any depression that may occur. Where bayonet or pike thrusts take place in the orbits, temples, or through the roof of the mouth, or the occipital foramen into the base of the brain, they are most generally fatal; indeed those through the orbit and base of the *cranium* are almost invariably so." (p. 280.)

We have in the museum at St. Thomas's Hospital an example of fatal perforation of the orbital plate of the frontal bone, of which Astley Cooper gives an account, by a girl, aged twelve years, falling on a pair of scissors, the point of which entered between the eyelid and the fore part of the globe of the eye; on the scissors being drawn out some blood followed; the eyelid fell, and she was unable to raise it; she did not however complain much of pain in the orbit, and had no pain in her head. Up to the third day " she walked about without fatigue, but then soon tired. On the fourth day she was still free from pain, except a little in the eye, but could not see with the other eye. She still walked about the room with assistance." On the fifth day she was out in a coach, enjoyed the ride though she could not see, and was in good spirits, but on returning home, " complained of fatigue, and went immediately to bed. At seven in the evening she was seized with convulsions in her limbs, and now and then her features were distorted. At twelve o'clock that night the convulsions left her, and her senses returned, which had been lost during the fit. She now for the first time complained of pain in her head, which she said was very violent and attended with a sensation of great weight. At nine o'clock on the morning of the sixth day the convulsions returned, and continued till her death on the following morning. On opening the cranium, a fracture was found in the orbitar process of the *os frontis*, in which there was a hole large enough to admit the point of the finger. In the *dura mater*, opposite this, there was a corresponding opening, with a portion of bone in it; between the membrane and bone some extravasated blood was collected. In the *pia mater* and brain there were also openings; upon the former there were some purulent appearances, in the latter there was an incipient suppuration, with inflammation extending into the ventricle." (pp. 295, 96).

GUTHRIE mentions two cases of similar injury. A boy was struck by his play-fellow with the end of a thick iron wire, on the right eye, which blackened it. There was no external wound; but, as there was some bloody chemosis at the upper part and inside, there was a probability of the wire having penetrated deeply, although the opening could not be discovered with the probe. He vomited shortly after, and for two days ate little, but did not think himself ill. He was then well purged, and cold water applied. Two days after he was complaining of sickness, headache, and pain over the brow, and looked ill. It was now suspected that the instrument had penetrated the brain, although the ecchymosis was in a great measure gone, and the eye was unaffected. He was bled freely from that temple with leeches, and freely purged with calomel and jalap. On the evening of the fifth day he was very ill, and delirious and restless all night; on the next was stupified; answered with difficulty and incoherently; had a very quick pulse, hot and dry skin; some convulsive twitchings of the face and arms; pupils slightly obeying a strong light, but not dilated. He was again bled freely; but his breathing became difficult; he fell into a comatose state, and died during the sixth night. The iron wire was found to have passed under the upper eyelid, between it and the eye, through the posterior part of the orbitar plate of the frontal bone, and into the anterior lobe of the brain, which was softened at that part and bedewed with matter.

A woman was struck on the left eye with a tobacco-pipe. She pulled a piece of the pipe, which was sticking in the orbit, from a wound under the lid, between it and the upper inner part of the eye, which was uninjured. A probe could be passed some distance in the course of the wound. She complained of little but the redness of the eye and the bruise. She was bled and purged, and had no symptoms for a week, when she complained of having been very ill at night, with nausea, headache, and shivering, hot dry skin, very quick pulse, and the upper eyelid paralytic. She was then bled largely, and purged freely, but became delirious the same night, and died in two days after first complaining of serious illness. Half an inch of the red-waxed end of the pipe had gone through the sphenoid bone, by the side of the *sella tursica*, and lodged in the brain, from whence it was removed bedewed with pus, the brain being yellow and softened around it. GUTHRIE says he has also seen two similar cases in children, and terminating in the same way. (pp. 137, 38.)

The relation of these cases shows the importance of giving a very cautious opinion as to the probable result of thrust wounds into the orbit, when at first there seems little expectation of material mischief.—J. F. S.

A very remarkable instance of recovery from wound of the brain, by a cheese-knife, is given by Dr. CONGREVE SELWYN (*a*) of Cheltenham:—" W. B., aged four years, whilst eating his dinner, in September, 1821, with his plate on a kitchen chair, placed one foot on the bar of that, and the other on the bar of another chair close by, and the chairs receding from each other, in consequence of the motion given to them, whilst his limbs were extended, he fell. The knife, a common cheese-knife, about four and a quarter inches long in the blade, and averaging three quarters of an inch broad, entered the right orbit nearly horizontally, to the depth of three inches and a quarter, immediately beneath the superciliary ridge, and penetrating (through the posterior part of the orbital plate of the frontal bone) the substance of the brain, injuring in its course the optic nerve and the *levator palpebræ* muscle, or the motor filament supplying it. The father told me it required all his force to dislodge the knife from its situation. The hæmorrhage was very slight. After the removal of the knife some portion of the brain protruded; more was discharged on the eighth day after the injury. He did not sleep for a fortnight after the accident, and was delirious during the night. The treatment consisted of low diet, little or no medical treatment, and the application of strips of adhesive plaster to the wound, which was entirely healed in six weeks. There was never any exfoliation of bone." He was alive and well seventeen years after, and the following is the interesting account of his then condition. " The eye shows the globe to be sound and healthy in structure, (this is not quite correct, as presently shown,—J. F S.,) though less prominent than the other. Its muscular actions are all regularly performed, except that of the *m. levator palpebræ superioris*. The vision is *entirely lost* in that eye; the pupil dilated, and wholly insensible to the stimulus of light. All the senses are perfect

(*a*) Lancet, 1827-28, vol. ii.

excepting the vision of the injured eye. The memory is very defective. He is incapable of applying to any pursuit requiring mental activity. His disposition is irritable, especially after indulging in liquor, or after any unusual stimulus He has occasional pain on the injured side of the forehead, and has once since had typhus fever. His bodily health is now good, and he has the free use of his limbs." (p. 16.)]

399. In these wounds the first indication always is the careful search for and withdrawing of foreign bodies; if they stick fast in the membranes of the brain or in the brain itself, an attempt must be made to loosen them by a cut, and to draw them out without violence. Balls in the substance of the brain are to be discovered by careful probing: if they be superficial they may be often withdrawn with a pair of forceps; care, however, must be taken that they be not pushed further into the brain (1). The head is to be put into such position that the fluids may readily escape, by which also the foreign body often moves, so that at a later period it can be drawn out. Trepanning is therefore always necessary when the given object cannot be attained by the existing wound (2). The dressing, should be mild; the wound covered lightly with dry charpie, a compress and fastened with the three-cornered head-cloth. The after-treatment must correspond to the degree of inflammation.

According to A. Cooper (*a*) pieces of bone penetrating the brain, if symptoms of pressure do not exist, should not be removed, because thereby, in all probability, extravasation would ensue. Brodie (*b*) recommends that foreign bodies penetrating the brain should only be drawn out if it can be done without any fresh wound, and he endeavours to support this opinion by cases.

[(1) Hennen's observations upon this point appear to me very important. He says:—"We would also naturally remove all extraneous bodies within view or reach; but before we commence any unguided search after them, we ought seriously to balance the injury that we may inflict. I by no means wish to be understood to say, that we ought not to endeavour cautiously to follow the course of a ball, when unfortunately it has got within the cavity of the cranium. M. Larrey asserts that can be done with safety and effect. He informs us that he traced a ball which entered the frontal sinus of a soldier during the insurrection at Cairo, by means of an elastic bougie, from the orifice to the occipital suture, in the direct course of the longitudinal sinus; and, by a corresponding measurement externally, he was enabled successfully to apply a trepan over it and extract it; the patient recovered. M. Percy, on the other hand, gives a fatal instance where a ball was absolutely within reach of the forceps, and yet, for want of a sufficient opening, and manual dexterity in the operator, it slipped into the brain; and although the opening was enlarged by the trepan, it could not be recovered. In the works of some of the older authors we meet with cases where epilepsy and various other bad symptoms have followed the attempts at extracting arrows and other missiles sticking in the brain; and in more modern practice there are many instances where patients have lain in a state of apoplectic stertor, with a ball lodged in the brain, for some time, but have expired on its removal. One instance of this kind has been reported to me, where a soldier died the very moment the ball was extracted. A modern surgeon would be severely and justly censured for not at least making a trial; but we are encouraged to look for the eventual safety of our patients, when the course or actual site of the ball or other body is unknown, by recorded and well-authenticated instances of life being preserved, when they either have not been looked after, or their existence has not been suspected. The records of Surgery furnish us with many proofs of metallic and other bodies lying for long periods between the *cranium* and *dura mater*; but experience shows that the extraneous bodies may lie even in the brain itself without producing death. I have seen no less than five cases where a ball has lodged in the substance of the cerebrum, without immediately producing a fatal event." (pp. 288, 289.)

Lawrence also mentions an example of a young man who discharged a brace of pistols into his mouth. One bullet "was found in the neighbourhood of the jaw, but the other was not to be met with at all. Inflammation of one eye took place after the accident, the cornea became turbid, and the sight of it was lost." He lived a fortnight, and on examination the other bullet was found to have gone through the orbit, behind the globe, on the side on which the sight was afterwards lost. It had entered the

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(*a*) Lectures on Surgery, by Tyrrell, vol. i. p. 315. (*b*) Above cited, p. 413.

cavity of the cranium, by breaking through the orbital process of the frontal bone, going through the anterior part of the brain, and then passing upwards about as far as the coronal suture, making a distinct track throughout its course upon the surface of the brain. In this instance there was no one symptom during the fortnight the patient lived that could have led one to suppose that any injury whatever had happened to the brain." (p. 523.)

(2) As in wound of the *dura mater* much danger is to be dreaded from the extension of the inflammation to and throughout the serous arachnoid membrane by which it is lined, the younger Cline advised that a puncture should be forthwith made through the arachnoid and *pia mater* into the surface of the brain, for the purpose of exciting a more active and immediate inflammation, by which the general serous cavity might at once be shut off from the wound that he thus hoped to circumscribe. I once saw him adopt this practice, but the patient died; the injury he had received, upon examination after death, showing itself to have been beyond remedy. Astley Cooper also recommended this treatment, but without acknowledging at whose suggestion.—J. F. S.]

400. When good suppuration takes place, a nourishing diet and constantly dry dressings are advisable. If the suppuration be bad and thin, if fresh symptoms of inflammation arise, there is probably some splinter, which it must be attempted to remove; or the pus may not flow freely, in which case it may be necessary to enlarge the opening in the bone by trepanning. If an abscess form in the brain, it must be opened with a lancet (1). If the patient be weak, the suppuration bad, or the wound itself gangrenous, strengthening remedies must be used, especially bark, and it must be bound up with astringent remedies, as lime water, decoction of bark or of elm bark, with tincture of myrrh, with digestive salves and the like. If a portion of the brain be entirely spoiled, it must be taken away. Loose pieces of bone must be carefully withdrawn. The dressings should be changed each time as quickly as possible, so that the wound be not long exposed to the air; care must also be taken that the air surrounding the patient should not be foul.

[(1) If there be any sufficient guide to the situation of the abscess, I do not see any objection to making a cut through the brain to it; but to ascertain this is always very difficult and generally impossible, as it by no means follows that the abscess is immediately opposite the part where the blow has been received. The case which Guthrie quotes from La Peyronie (*a*) appears to be merely a simple circumscribed collection of pus beneath the *dura mater*, which, as its quantity increased, enlarged its cavity at the expense of the brain, so that it was presumed to have attained the size of a hen's egg, and to have descended to the *corpus callosum*. It was immediately emptied by puncturing the *dura mater*.

Dupuytren's case (*b*) is, however, an abscess in the substance of the brain. A young man was wounded on the head with a knife; the wound healed, leaving only a little pain, which occasionally came on about the scar. Some years after he was brought to the Hôtel-Dieu, in a state of stupefaction, with which he had been suddenly seized. An incision through the scar exposed the point of the knife sticking in the bone, the removal of which gave no relief. The trephine was also applied without benefit. The paralysis continuing on the side opposite to that on which the wound had been received, it was determined to open the *dura mater*, and plunge a knife into the brain, which evacuated a large quantity of pus. The paralysis ceased that night; he recovered his speech, became sensible, and entirely though gradually recovered.]

401. Foreign bodies often remain in the brain with different consequences. Sometimes they do not give rise to the slightest symptom through the whole of life; sometimes merely pain is produced when the head is placed in a certain position; sometimes they cause cramps, and epileptic fits; often sudden coma, convulsions, and death.

[Numerous examples are given of foreign bodies lodged in the substance of the brain, and producing symptoms of less or greater severity; but in the greater number it will be found, that after a few months they die either suddenly, or from some inflamma-

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(*a*) Sur la partie du Cerveau où l'Ame exerce ses fonctions; in Hist. de l'Acad. des Sciences, 1744, p. 199.

(*b*) Lancette Française, 14th Oct. 1830.

tory attack of the brain. If therefore they remain quiet during life, it may be presumed that they assist in shortening it.

A very remarkable instance is mentioned by **Langlet** (*a*) of a seven-drachm ball remaining for eighteen months in the brain, enveloped in a sort of membranous covering attached to the *dura mater*, and which contained pus.]

A.—OF INFLAMMATION OF THE BRAIN AND ITS MEMBRANES.

402. *Inflammation of the Brain (Encephalitis)* may occur in every injury of the head; and its causes are, the operation of external violence, the splintering and indenting of bone, injury of the brain and its membranes, violent separation of the *dura mater* from the skull, bruising of the *diploë*, collections of matter under the tendinous aponeurosis, and so on. Inflammation arises either soon or later after the injury, and is severe, quick in its course, or slow. Its appearances are various, according as the inflammation proceeds from the *dura mater* or from the brain itself, and as it passes from one structure to the other. Its usual termination, when it does not disperse, is suppuration.

403. *Acute Inflammation of the Dura Mater (Meningitis traumatica acuta)* appears most commonly from the third to the fifth day; the patient complains of severe, oppressive head-ache, which spreads from the injured part over the whole head; the warmth of the head is increased, the pulse small, compressed and rather hard; the patient is heavy, difficult to rouse, his ideas become unconnected, quiet delirium comes on; and lastly, when the inflammation proceeds to suppuration, the patient falls into a continued state of stupefaction from which he cannot be easily roused: convulsions come on, continued shivering, irregular pulse, the pupils are wide and fixed, the breathing snoring and slow; the sphincters are paralysed and the patient dies. On dissection the *dura mater* is found reddened, covered with exudation, separated from the inside of the skull, pus between it and the bone, and at this part the *dura mater* often gangrenous.

404. *Chronic Inflammation of the Dura Mater*, which in injuries commences only after a long space of time, often after seven or fourteen days, often after a month, begins with headache, with mental and bodily depression, heaviness, unsteady walk, gastric symptoms, quick pulse, and in its further course a circumscribed painful swelling of the coverings of the skull commonly arises at the place of the injury, or if there be a wound it becomes pale, and secretes a thin sanious fluid, which sticks fast to the bandages. The *pericranium* separates around the wound, and the inflammation soon runs into exudation of a yellowish ichorous purulent fluid, which collects either between the skull and the dura mater, or between the latter and the surface of the brain. (*par.* 386.)

[**Astley Cooper** mentions the case of a woman who had this chronic inflammation of the *dura mater*, which terminated in suppuration and caries of the bone above it. She had fallen upon her forehead against a chest of drawers, which produced a small wound and great contusion: but she got well, excepting some pain and a sense of weight in the head, which continued to increase, became very severe, and at the end of eight months she was attacked with epilepsy. She had then a purulent discharge from the nose and ears, which relieved her; but it ceased after three days, and she was as bad as ever. This occurred again and again. But she got worse, lost her appetite, had very distressing pain in the head, especially at the part where the blow had been received, which was increased by pressure. She slept but little, became very irritable, and was often convulsed on the slightest disturbance. At last she was quite comatose, and

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(*a*) Bulletin de la Faculté de Médecine, No. 19.—1812.

then **Birch** of St. Thomas's, whose patient she was, cut through the scalp, but did not observe any disease in the *pericranium* or bone. The discharge from the wound at first afforded some relief; but it became fetid, the *pericranium* separated, the bone was carious, and an aperture in it allowed the passage of pus at every pulsation of the brain. A trephine was therefore applied to render its escape more ready; and, on the removal of the bone, the *dura mater* was found inflamed and gangrenous. She died next day, about nineteen months after the accident. (p. 326–28.)

I have seen several cases of this chronic inflammation, which is always a very serious disease, and very difficult of control; often indeed entirely unmanageable. The patient goes on slowly from bad to worse, sometimes with intervals of improvement, sometimes without, and will frequently live in a state of constant suffering for many months.—J. F. S.]

405. *Acute Inflammation of the Brain* (*Encephalitis acuta traumatica*) begins immediately after the injury, with severe, constant, increasing pain in the head, uneasiness, sleeplessness; the eyes are red, intolerant of light, the pupils contracted, countenance red, the carotids beat actively, the head is hot, the pulse full, hard, and vibrating. Contractions of the muscles of the face, and of the whole body, and severe violent delirium ensue. If the inflammation do not subside, it may be fatal by its severity, by the gorging of the brain with blood, and paralysing of the brain thereby; or it goes on to suppuration; symptoms of pressure on the brain, constant sleepiness, but often broken by delirium, and all the above-described symptoms (*par.* 403) come on, and death ensues. On dissection, the brain is found full of blood, its medullary part reddened, and, when cut through, a quantity of bloody points, and even extravasated blood; collections of pus may also be noticed at various parts on the surface of the brain, or in its substance.

406. *Chronic Inflammation of the Brain* (*Encephalitis chronica traumatica*) frequently comes on very late; its symptoms are commonly deceptive, and, at the first, easily overlooked; often showing intermission or remission. Bodily and mental depression, continued headache, febrile shiverings, and the like occur for a shorter or longer time; and with the passing of the inflammation into suppuration, the disturbance of the brain becomes greater, or symptoms of compression come on. Examination after death shows either a defined or diffused collection of pus in the substance, or on the surface, of the brain (1).

[(1) It is quite impossible to determine the length of time which abscess in the brain has existed before it produces symptoms, as its only indications are the symptoms of compression, which come on two or three, or three or four days previous to death. The size of the abscess often leads to the belief that it cannot have been formed in the few days during which symptoms have existed; and its situation seems to have material influence on the appearance of the symptoms, proportionate to the importance of the part of the brain immediately compressed. Thus a large abscess may exist in the upper parts of the brain, which probably has occupied some time in its formation, yet symptoms of pressure appear only two or three days before death. Whilst, on the contrary, a smaller, or even a small abscess at the base of the brain, or near the origin of the nerves will produce symptoms, probably at any earlier period, which are more decided and severe. Hence though it is customary to speak of death from abscess in the brain, at various periods after the reception of an injury, it must not be supposed that the abscess has existed during any very considerable portion of that time, though it has probably commenced its formation much before its existence was suspected.

Sometimes the abscess in the brain appears to be sympathetic, with irritation and suppuration of the *dura mater;* a good example of which is presented by the following **Case** under the care of my friend **Green** (*a*):—A boy, aged twelve years, was admitted into St. Thomas's Hospital, *Oct.* 26, 1827, having ten weeks previously received a blow on the forehead, followed by abscess, from which several ounces of pus were discharged by puncture; and he recovered. Three weeks before his admission he had an epileptic

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(*a*) Lancet, 1827–28. vol. i. p. 687, 88.

fit, which was followed by incomplete paralysis of the left side. His limbs were shrunk; his face pale, his eye peculiarly wild, his countenance peevish and anxious. He was restless and irritable, and when spoken to he would only scream out, "my head aches," putting his hand at the same time to his forehead. The scalp was hot, but the surface generally cool; the pupils especially the right, much dilated; pulse small and 120. He could not move either of the left limbs; the motions were very fetid, and passed involuntarily, as did also the urine. He pointed to what he wanted, rather than asked for it. His head was ordered to be shaved; leeches and cold lotion to be applied. Chalk mixture to check the action of his bowels, and a drachm of mercurial ointment to be rubbed in nightly. The leeches were repeated on the next day. *Nov.* 2.—The pain in the head still severe; but he moves his left side more freely. On the 5th his gums were affected by the mercury; the headache only at intervals, and the heat of the scalp diminished; a blister was put on the occiput. A week after he was capable of retaining both stools and urine, and the powers of motion were improved; but the headache was very severe; the pupils dilated and insensible to light; pulse still quick and small, and the surface quickly cooling when exposed. The mercurial friction was now left off. Another blister was applied in the course of the week, and on the *19th* he was ordered *dec. cinch.* ℥jss. *acid. mur.* ♏viij. *t. d.* A puffiness soon after began to appear above the cicatrix, and extended to the left eyelid; and on the *26th* distinct fluctuation being felt, a lancet was passed into it, and blood flowed freely, as from opening a vein, without any pus, but after a minute ceased spontaneously. A deeper wound was then made, and about half-an-ounce of cheesy matter escaped. A poultice was applied, and a dose of calomel given. A slight discharge of pus followed, but in three or four days the wound healed. He continued still very irritable; but the headache varied, and when most violent the pupils were dilated. On the *18th Dec.* pus was again discharged from the forehead, and also at the left angle of the jaw; the bowels were much relaxed; he gradually sunk and died on the *31st*. *Examination.*—The scalp was found to form the front boundary of the frontal sinuses, their external table being entirely absorbed; but there was little pus. The inner table was *almost* perforated in many places, and completely in one, but there was not any pus between it and the *dura mater*, which was vascular, especially over the sinuses. The longitudinal sinus was full of pus, and lined with organised lymph; both the lateral, the inferior longitudinal, and inferior petrosal sinuses were also distended with pus; in the right lateral was a hard plug of lymph at the part where it turned to the temporal bone, and the left was filled with lymph to the lacerated hole; the orifices of many of the veins into the longitudinal sinus, and to some distance from it, were filled with pus: the *pia mater* was loaded with blood. A small abscess was on the surface of the right hemisphere, near to the longitudinal sinus, but not communicating with it. In the left lobe of the cerebellum was a large abscess. There were also abscesses in the lungs, one in the left kidney, and a few small ulcers on the mucous membrane of the ileum and colon.

PROCHASKA (*a*) has also mentioned a similar case of a boy struck on the head by the handle of a winch, whilst drawing water from a well. He received a slight wound, which soon healed; but he suffered much headache, became dull and heavy, and after some weeks was attacked occasionally with convulsions of the whole body, which ceased spontaneously. Rather more than four months after he fell suddenly into the same state, and was brought to the hospital in that condition a week after. Under treatment he began to recover the use of the paralytic hand and foot, and both to see and talk better. After some days, a soft, fluctuating swelling, without pain or redness, appeared on the forehead, where the blow had been received, and, when cut into, a large quantity of black half-coagulated blood was discharged, and the frontal bone felt rough to the finger. At every daily dressing there was a free discharge of similar blood. Soon after he had very severe bleeding from the nose, which relieved the headache; it recurred every day till the fourth, on the morning of which he sunk into a deep sleep, broken only by convulsions, and in the evening he died.

The *examination* showed the frontal bone rough and porous opposite the swelling; the vessels of the *dura mater* were loaded with blood, and pressure upon the longitudinal sinus caused the blood to flow through the porous frontal bone, the sinus itself having several openings into the *diploë*, behind the injured part of the bone through which the blood passed. On the upper part of the left hemisphere the *dura mater* adhered so firmly to the brain, that they could not be separated without tearing. The cortical part of the brain was here very thin; the convolutions had nearly disappeared; and beneath it was a large oval swelling, hard but fluctuating, over the left ventricle, extending throughout the whole hemisphere, and occupying two-thirds of the transverse extent of the skull,

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(*a*) Observationes Pathologicæ, sect. iv. Cas. tert.; in Opera Minora. Viennæ, 1800.

so that it thrust the *falx* much to the right, and compressed the right hemisphere. The cavity of the left ventricle was almost entirely destroyed; the left striated body flattened, and the optic bed, *septum lucidum*, *corpus callosum*, and junction of the optic nerves were driven much to the right. The size of the right ventricle was diminished, and it contained little fluid. The medullary substance was very soft around the swelling, so that the latter, which was distinctly encysted, and contained much pus, was readily turned out of it with the finger. In the right hemisphere the medullary matter was very firm.]

407. The symptoms and course of traumatic inflammation of the brain and its membranes may be variously modified, by the simultaneous attack of both brain and membranes, by the occurrence of inflammation in existing pressure of the brain from depressed bone, or by previous concussion of the brain.

408. The *prognosis* of inflammation of the brain depends upon the possibility of removing its causes. If the inflammation continue, it runs on to suppuration, and then upon the seat and extent of the collection of pus depends whether it can be removed or not. It is, therefore, the first duty of the Surgeon to examine closely the part of the head on which the external violence has acted, and if splinters, indents, and so on be present, they must be removed according to the rules laid down.

409. The inflammation requires the strictest antiphlogistic *treatment*, bleeding from the arm, in the jugular vein, leeches to the head, to the neck, of which the bleeding should be kept up for from twelve to twenty-four hours, by the repeated application of the leeches; internally, antiphlogistic purgatives, calomel in smart doses (1), and especially the continual application of ice or of SCHMUCKER's solution, (four ounces of nitrate of potash, two ounces of muriate of ammonia, a pint of vinegar, and ten pints of water,) no remedies being so efficient as cold fomentations to prevent inflammation. They must, therefore, as well as the prophylactic bleedings, be from the first employed in every injury of the head in which inflammation of the brain is to be feared (2).

[(1) In the treatment of inflammation of the brain or its membranes, the principal reliance is to be placed on the use of mercury, till it produces ptyalism; soon after the appearance of which the symptoms begin to be less severe, and therefore the more quickly the constitution can be affected, the more favourable may be the expected results. On this account the calomel should be given in two-grain doses, every eight, six, or even four hours, according to the severity of the symptoms, and even rubbing in mercurial ointment may be also employed twice or thrice a day. So soon as the mercurial fetor of the breath is observed, and the gums begin to separate from the teeth, it will be seen that the constitution is beginning to be laid hold of by the mercury, and then the quantity given or rubbed in must be diminished to that only which is sufficient to keep up the mercurial action.

(2) After free evacuations of blood, which I think are most effectual when local, by cupping on the nape, temples, or behind the ears, a large blister over the whole scalp, or on the nape, if the scalp be wounded, is often extremely beneficial.—J. F. S.]

410. If, with this treatment persisted in with sufficient energy, and for proper length of time, the symptoms of gorging and inflammation of the brain continue undiminished, or rather if they gradually increase, especially when the bared bone shews a grayish colour and change in its texture, trepanning must be had recourse to. In this case it is probable that some cause, as a splinter or extravasated blood, exists within the skull, which keeps up the inflammation, and renders all treatment useless, but may be found out and removed by trepanning.

411. If the symptoms of suppuration have already appeared, the prognosis is very unsatisfactory indeed; there is, however, the simple possibility

of rescuing the patient by the speedy application of the trepan upon the spot where he first suffered the inflammatory pain. Generally, however, in these cases, if the suppuration be much extended, the trepan must be applied in several places, the *dura mater*, the surface of the brain itself cut into, if pus be collected beneath it. Trepanning, however, can in any possible way only be useful when the pus is found circumscribed between the skull and *dura mater*. In outpourings over the surface of the brain, it is useless and in collections of pus within the substance of the brain itself, even after the *dura mater* has been cut into, the seat of the pus cannot be well determined. Many observations, however, show satisfactory results even in such extreme cases.

The cases of LA PEYRONIE and DUPUYTREN, in which abscess in the brain was punctured, have been already noticed. (*par.* 400, *note.*)

In reference to abscesses in the brain found on dissection, and the opening of which have confirmed their position, see LA PEYRONIE (*a*), ROUX (*b*), VELPEAU (*c*).

412. Everything depends on averting the slow insidious inflammation of the brain which occurs at a later period. In every injury of the head, the patient is therefore to be closely watched, the antiphlogistic treatment, and especially the cold fomentations to be long persisted in, and the proper relief of the bowels attended to. If the symptoms already mentioned (*par.* 386) exist, the patient can only be saved, if the suppuration be confined upon the *dura mater*, by a slight cut in the swelling there formed, and by trepanning. But if the outpoured pus overspread the greater part of the *dura mater* or of the brain, every kind of treatment is generally useless.

413. It must, however, be remembered that oftentimes symptoms resembling those of inflammation of the brain arise from bilious and other impurities in the bowels, which can only be relieved by vomiting and purging.

B.—OF PRESSURE ON THE BRAIN.

414. ***Pressure of the Brain*** (*Compressio Cerebri*, Lat.; ***Druck des Gehirnes***, Germ.; *Compression du Cerveau*, Fr.) may be produced by outpouring of blood, lymph, or pus, within the cavity of the skull; by depression of pieces of bone or by foreign bodies which have penetrated within the skull.

The general symptoms of pressure of the brain vary according to the degree of pressure. In a slight case the patient feels a dull headache, faintness, singing in the ears, dimness of sight, wide pupils, difficult voluntary motions, deafness, loss of memory. In a more severe degree, he lies in a deep sleep, from which he cannot be waked, his breathing is snoring (1) and difficult; the pulse full, hard, and irregular; the pupils wide, and the eyes fixed; there is palsy, convulsions, involuntary discharge of the stools and urine, a peculiar stiffness of the neck, as if the head were nailed to the trunk; not unfrequently bleeding from the nose and ears, and high fever are present. In the greatest degree the patient dies apoplectic.

[(1) GUTHRIE makes some very good observations on the uncertainty of snoring as a symptom of compression; and also mentions a peculiar whiff or puff at the corner of the mouth, which I have often seen, and do not think is to be considered a special symptom of injured brain. "Stertorous breathing," says he, "has always been considered a sign

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(*a*) Mémoires de l'Académie de Chirurgie, vol. i. p. 319.

(*b*) Archives Générales de Médecine, vol. xxiv. p. 81.

(*c*) Above cited, p. 85.

of extravasation causing compression of the brain; I have, however, seen many cases of slight extravasation, with partial loss of power of one half of the body, accompanied by great numbness, without any stertor in breathing; although I have never seen a well-marked case of large extravasation without it, or another peculiarity of breathing which is less thought of, although an equally characteristic and dangerous sign of such mischief having taken place, when it is permanent; I allude to a peculiar whiff or puff from the corner of the mouth, as if the patient were smoking, and which, when observed among other urgent symptoms, is usually followed by death. Stertorous breathing, and the whiff or puff at the corner of the mouth, are presumed to indicate an injury to the cerebro-spinal axis as well as to the cerebrum; but whether the injury is direct or indirect is uncertain, although it is frequently accompanied by extravasation or laceration. When the breathing is only oppressed, or laboured, or heavy, neither extravasation nor lesion to any extent can in general be discovered after death." (p. 17.)]

415. The following general circumstances point out the causes of pressure of the brain. In fracture of the skull with impression, the surgeon discovers it by the sight and touch. In extravasation of the blood, the symptoms appear most commonly some time, some minutes or hours, after the injury. When the extravasation at once produces symptoms it is generally fatal. The seat of the extravasation may be between the *dura mater* and the skull, beneath the *dura mater*, under the *pia mater*, in the substance of the brain, in the ventricles, or on several other places at once, but no definite symptoms mark the particular spot. Only in extravasation of blood between the skull and the *dura mater* is the *pericranium* always less attached, and in trepanning the bone does not bleed, so that even from the very onset of the extravasation its existence may be determined by that circumstance. In elderly persons, however, these signs are less certain. Serous or purulent extravasation always takes place some time after the previous accident, after symptoms of irritation, inflammation, or concussion have come on. If the extravasation be between the *dura mater* and the skull, a circumscribed swelling is produced externally by the separation of the *pericranium*. (*par.* 386.)

416. The *prognosis* of pressure on the brain depends on its degree, its causes on the accompanying injuries, and on the constitution of the patient. What relates to impression of the skull has been already mentioned. Extravasation of blood in young subjects and in small quantities may be dispersed. Outpouring of blood into the substance of the brain or at its base is generally fatal. If the symptoms of inflammation be accompanied with pressure, the prognosis is so much the more unsatisfactory.*

417. The *treatment* of pressure of the brain consists in the removal of its causes and in preventing inflammation. In impressions of the skull or when foreign bodies have penetrated from without into its cavity, the rules already laid down must be employed.

[The use of calomel to ptyalism, as already mentioned in treating of inflammation of the brain, (*par.* 409,) is here also indispensably necessary.—J. F. S.]

418. Extravasation of blood may be removed either by absorption or by trepanning. The absorption may be attempted if the symptoms be slight, do not increase, and if the seat of the extravasation be probably unconnected with any external injury. The means employed for this purpose are repeated blood-lettings, purging, and cold fomentations.

419. If the symptoms of extravasation be severe, if they do not subside under active antiphlogistic and derivative means, but, on the contrary, increase, if there be on the head any injured part at which the violence has especially acted, which is painful or swollen, and if it be found by a cut that the *pericranium* is not attached but loose, then that part must be trepanned.

The patient is often attacked with giddiness at that part of the head where extravasation has taken place. That it is met with on the opposite side to that on which palsy occurs, or that the palsy of a particular part points out the seat of extravasation is an opinion not generally confirmed by experience. If the extravasation be not found on one application of the trepan, another part may be trepanned where external violence has equally operated. If the extravasation be beneath the skull, it flows out after trepanning (1); bleeding from the *diploë* must, however, be distinguished from it. If the *dura mater* be stretched, violet-coloured, fluctuating, it may be divided by a suitable cross cut. If the extravasation be beneath the *pia mater*, it also must be cut into (2).

Pressure of the brain from pus and lymph have been already treated of in considering inflammation of that organ and its membranes. (*par.* 400 and 411.)

[(1) This is a very incorrect statement. The blood rarely, if ever, flows out after the trepan has been applied. It is almost invariably found coagulated; and, therefore, though a little bloody serum may escape, the bulk of the blood still remains upon the *dura mater*, and always requires removal by careful scraping with an eyed probe, or with the edge of a spatula where it can be easily reached. But the clot generally sticks so fast, that the *dura mater* cannot be entirely freed from it; and, even in the most favourable cases, suppuration of the surface of that membrane is the usual consequence. —J. F. S.

(2) There has been great difference of opinion amongst the Surgeons of this country in regard to the propriety of puncturing the membranes of the brain, when extravasated blood is presumed to be between the *dura mater* and the brain; and I must confess I am rather disposed to agree, for the reasons presently given, with those who think little advantage likely to result from cutting through the *dura mater*. The subject, however, is so important, that it is right to state the opinions which have been held by the supporters of the different practices. Pott is in favour of puncturing the *dura mater*. He says:—" If the disease lies between the *dura* and *pia mater*, mere perforation of the skull can do nothing; and therefore, if the symptoms are pressing, there is no remedy but the division of the outer of these membranes. The division of the *dura mater* is an operation which I have several times seen done by others, and have often done myself; I have seen it and have found it now and then successful; and from those instances of success, am satisfied of the propriety and necessity of its being sometimes done." He does not, however, withhold the fact, that " wounds of the membranes of the brain, by whatever body inflicted or in whatever manner made, have always been deemed and (which is more to the purpose) have always been found to have been hazardous." (p. 260.)

He also observes, that " when the extravasation is situated between the meninges, or on the surface of the brain, the appearance is not the same" (as when between the *dura mater* and skull.) " In this case there is no discharge upon removing the bone; and the *dura mater*, instead of being flaccid and readily obeying the motion of the blood, appears full and turgid, has little or no motion, and pressing hard against the edges of the perforation rises into a kind of spheroidal form in the hole of the perforated bone. If the extravasation be of the limpid kind, the membrane retains its natural colour; but if it be either purely fluid blood, or blood coagulated, and the subject young, the colour of the membrane is so altered by what lies under it, that the nature of the case is always determinable from this circumstance." (pp. 264, 65.)

Brodie holds that there are cases in which puncturing the *dura mater* is warrantable. He says (*a*):—" We may regard it as a general rule, that an operation is not applicable to cases of compression of the brain from internal extravasation. But there are few general rules in Surgery to which some exceptions may not be made. Let us suppose a case in which a considerable portion of bone has been already removed, in which the *dura mater* is seen exposed, of a blue colour, lifted up by a collection of blood beneath it, and bulging as it were into the aperture which has been made in the *cranium*. Are we justified in puncturing the *dura mater* for the purpose of allowing the extravasation to escape? Every thing that we see of wounds of the *dura mater* tends to prove the very great danger of this kind of injury. The *dura mater* should never be wantonly punctured; but we cannot doubt that, in what may be regarded as desperate cases, it must be right

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(*a*) Cited at head of Article.

to give the patient the chance, small as it may be, which the division of the *dura mater* affords him. The combination of circumstances which would lead to such an operation must be very rare, but it may occur nevertheless, and the surgeon should be prepared to meet it." In support of this opinion he mentions two cases:—A child of eighteen months old, under the care of CHEVALIER, had a blow on the head, lay insensible, and was convulsed. No wound existed, but the fontanel appearing somewhat elevated, CHEVALIER raised the skin above the membrane forming it, and exposed the *dura mater*, beneath which the purple colour of the blood was plainly seen. He therefore made a careful puncture, and "the blood issued at first with considerable force, spouting to the distance of a foot. Three or four ounces of blood escaped; the symptoms were immediately relieved, and the child recovered." A woman who had fallen down the stairs of a cellar, was under OGLE's care, who found her without wound, and lying as if in a fit of apoplexy, but "she flinched very much when pressure was made on one spot near the anterior and superior angle of one of the parietal bones." He divided the scalp, applied the trephine, and "the *dura mater* of a dark colour rose into the opening nearly as high as the external surface of the *cranium*." He made a puncture in it, which "was instantly followed by a stream or jet of blood which spirted out to the height of some feet. Immediately on the blood being discharged, the woman, who till that moment had continued totally insensible, opened her eyes. After looking about her apparently amazed, she exclaimed, 'What's the matter? what are you doing with me?' and was able to give a clear account of the manner in which the accident occurred. From this time she recovered without any untoward symptom. It was impossible to ascertain the precise quantity of blood which escaped through the opening of the *dura mater*, but OGLE supposes it to have been about three quarters of an ounce." (p. 388–91.)

JOHN HUNTER properly observes (*a*):—"The *dura mater* must not be perforated without good grounds; we should be as certain that there is fluid contained under the *dura mater*, as we were certain of the necessity of applying the trepan in the first instance. In all cases where I have seen the *dura mater* wounded, it was by a crucial incision, and the patients have all died. When it is necessary to open the *dura mater*, I would recommend making a simple incision, for this would be more likely to heal by the first intention, and we could then move the edges to one side, and see if there were any injury below. Whenever I have seen the *dura mater* opened, the brain has worked through the opening, and the patients have died." (pp. 494, 95.)

"If blood be not found between the *dura mater* and skull," says ASTLEY COOPER, "do not puncture the *dura mater* to seek for it; it is of no use, as the blood is coagulated and will not escape, and it is seated under the *pia mater*, or in the brain itself." (p. 289.)

ABERNETHY was used to make the following observations (*b*) in reference to puncturing the membranes for presumed extravasation:—"Are you warranted to trephine to let out the blood from between the meninges? This is a very difficult question, and I would not undertake to reply to it. I *think* we are not warranted; there may be symptoms, but the bone not injured, and the vessels may be burst in the brain. Are we then to trephine at a hazard? If we do, we shall find the brain thrust up as if there were blood; we must then puncture, but if it is any time from the accident we shall not be able to let all the blood out, it is grumous, not coagulated, but as if it were mixed; I, have, however, seen it coagulated. Here we shall have inflammation, and we have taken away both the support of the bone and *dura mater*. I will tell you a

"CASE.—A woman had a thump of the head; she was in a state of apoplexy, but the bone was not broken. This occurred in a country town, and the older surgeons said they would not trephine; but a young man who was also called in, said that the symptoms were so indisputable, that he would see what was the matter. He trepanned her, and found the *dura mater* thrust up through the opening; he put in a lancet, and eight or nine ounces of blood gushed out. Immediately the woman, who had been cold and like a corpse, sat up and hallooed out, 'What are you doing?'"

LAWRENCE observes:—"When blood is effused between the *dura mater* and the surface of the brain, it is not collected into one spot, but is diffused over the surface of the brain generally, and then we cannot get at it. When the blood is effused on the external surface of the *dura mater*, it is collected in one spot, because it is confined by the adhesions between the *dura mater* and the skull; but when effused *within* the cavity on the internal side of the *dura mater*, there is nothing to limit its extension, so that it diffuses itself generally over the brain. I believe we may say, therefore, as a general rule, that if we make a perforation through the skull in expectation of letting out blood that may be effused under it, and find none, but that the skull adheres in the natural way to the

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(*a*) Lectures, PALMER's Edition, vol. i.

(*b*) MS. Lectures.

dura mater, we shall do no good by opening the *dura mater* in expectation of letting out the blood that may be supposed to be under it." (p. 525.)

The advantage gained by trepanning, in cases where extravasation of blood is presumed to have occurred, is, as far as I have had the opportunity of observing, very slight, as it is utterly impossible to determine whether the blood be poured out between the skull and *dura mater*, between the membranes themselves, between the *pia mater* and the brain, or in the substance of the brain itself or in its cavities. Only when the outpouring is between the skull and *dura mater* is there the least probability of material benefit; and even here it mainly depends on the blood being shed at one particular spot, so as to form a lump, for if it spread thinly to a large extent, as commonly happens, it cannot be got at. Hence is it, that when the blow has been received upon the temple, upon or near the track of the middle artery of the *dura mater*, there is greater hope of a successful result than at any other part; though even there doubtful. The trephine, however, ought always to be applied when there is reasonable presumption of that vessel having been burst or torn by the violence of the shock; and it is an interesting fact, that when the bone has been, under such circumstances, removed, and the artery, as usually happens, is found bleeding fiercely, as in one of ABERNETHY's cases, it ceases to do so immediately the clot has been cleared away. Perhaps also it may be advisable, when the blow has been received on the track of a sinus, to trepan on either side of it, and ascertain the existence of any out-poured blood.

Another occurrence, by no means unfrequent, and which cannot be ascertained before operation, renders trepanning of still more doubtful success, to wit, the tearing of a vessel by the counter-shock, at some part far distant from that where the blow has been received; thus the right side, or the crown, or the front of the head may have been struck, and the blood may be poured out on the left side, at the base, or on the back of the head; circumstances which must not be forgotten. When the blood has been cleared away, if it have been poured out in one particular spot, there is always a corresponding hollow by the thrusting down of the *dura mater* into the substance of the brain; in one of ABERNETHY's cases it was an inch and a-half deep. I have never seen any depression so great as that; but I have seen a very distinct hollow, porportionate to the circumscription of the clot. After the removal of the clot, the *dura mater* which has been thrust in, seems to hang loosely in the hollow of the brain; sometimes at first motionless, the brain apparently being incapable of rising and effacing the hollow, so that hours may pass by before the brain and its membranes recover their natural place and form; at other times a little pulsating movement in the depressed *dura mater* is observed, which becomes more and more distinct, and simultaneously both it and the brain rise up, the hollow disappears, and at every pulsation the *dura mater* is driven upwards and protrudes slightly within the aperture formed by the trepan.—J. F. S.]

C.—OF CONCUSSION OF THE BRAIN.

420. *Concussion of the Brain* (*Commotio Cerebri*, Lat; *Erschütterung des Gehirnes*, Germ.; *Commotion du Cerveau*, Fr.) produces, immediately after the operation of external violence, fainting, stupor, insensibility, or sudden death. There are various degrees of concussion of the brain characterized by the following symptoms:—

The person who is struck by external violence, tumbles together, is unconscious, but soon recovers himself and complains of confusion of his ideas, faintness, disposition to sleep, singing and rushing in the ears. In a more severe degree of concussion the patient does not so soon recover from his insensibility, he lies motionless in a deep sleep, his countenance is pale, limbs cold, breathing easy, the pulse small, regular (1); the eyes are insensible to light; the breathing often scarcely perceptible; and only a more or less warm perspiration tells of feeble vitality. When the patient comes to himself there often continues some disturbance of the senses; he stutters, cannot utter single words or letters (2); one or other limb of the body does not move freely; and he has generally not the least knowledge of what has happened to him. In concussion there is always more or less severe vomiting (3). In the most severe degree of concussion the person drops at the very moment when struck, and dies on the spot.

[(1) "The state of the pulse," says **Astley Cooper**, "is curious, although, when the patient is undisturbed, it is natural; it scarcely ever fails to be quickened if the patient is capable of making any effort to rise, and exerts himself for that purpose. The carotid arteries sometimes beat, under an exertion, with a force disproportionate to the other arteries of the body; but generally this symptom is not observed until after a few hours." (p. 254.) Not only is the pulse excited by the patient's effort to rise, but even the mere shaking him to arouse him will often produce quickening of the pulse, as I have seen again and again.—**J. F. S.**

(2) Many curious instances are recorded of the loss of memory in regard to an acquired language, and the re-employment of the vernacular tongue of the patient, following concussion. **Astley Cooper** mentions the case "of a man who, in St. Thomas's Hospital, was found talking in a language which was not understood, until a Welshwoman entering the ward, heard him talking Welsh; the blow on his head having occasioned the loss of his recollection of English. I once witnessed a very similar circumstance:—I attended a German sugar-baker, with disease in his brain, and when I first saw him, he could speak to me in English; but as his disease increased he lost his English, and I was obliged to have an interpreter, for he could answer only in his native tongue." (p. 255.) Sometimes the patient forms a new language for himself, as in **Larrey**'s case (*a*) of the soldier wounded in the head, who expressed assent by the word "baba," instead of "oui," dissent by "lala," and his wants by "dada," and "tata." In other cases of irritation of the brain, language appears to have been entirely lost, and the patient to have made his necessities known by manual signs, as in **Cline**'s case. (p. 418.)

Hennen observes:—"The powers of speech are often lost, while those of memory remain, and the sight is impaired while the hearing is perfect, and *vice versâ*. I have met with numerous instances of this, and have had patients who told me that they could hear distinctly what I said, and distinguish my voice from that of others, and have repeated my words, as a proof both of this fact and of their retention of memory, while they could not distinguish my person, nor give utterance to their thoughts." (p. 305.) He also mentions a very remarkable instance, after compound fracture with depression of the skull from gun-shot, in which, though the patient continued sensible, he lost the power of utterance, and, although his efforts to speak were continuous, only on the sixth day did he manage to "utter audibly, though with much labour, the monosyllable 'ther,' to which in the course of the day he added, 'o;' and for the three next days, whenever addressed, he slowly, distinctly, and in most pathetic tone, repeated the words, 'o; ther: o; ther;' as if to prove his powers of pronunciation. His general appearance, during all this time amended considerably, and my hopes now began to revive. I therefore resolved to write to his family, and before doing so, I printed in large characters on a sheet of paper the following words, 'Shall I write to your mother?' that being the wish which it appeared to me he so long and ardently laboured to utter. It is impossible to describe the illumination of his countenance on reading these talismanic words; he grasped and pressed my hand with warmth, burst into tears, and gave every demonstration of having obtained the boon which he had endeavoured to solicit." (p. 308.) The recital of this interesting case is an ample proof of the kindness of **Hennen**'s heart, and of the sincerity with which he inculcated the propriety of "tenderness and sympathising manner" in the conduct of Surgeons towards their patients.

(3) To the symptoms above enumerated **Astley Cooper** adds:—"At first a torpor exists in the intestinal canal, and a considerable difficulty in procuring an evacuation; but afterwards the fæces are involuntarily discharged: in a few hours the bladder is distended from the accumulation of urine, which demands the introduction of a catheter for its removal; but after some time the urine also passes involuntarily." (p. 254.)]

421. The following circumstances distinguish concussion from pressure of the brain, depending on extravasation of blood: the earlier or later occurrence of symptoms in extravasation depends indeed on the quantity of blood and the quickness with which it is poured out; but the symptoms once set in increase or continue in the same degree. In concussion which immediately follows external violence the patient usually recovers himself in some degree. In extravasation he lies in an apoplectic state, with snoring difficult breathing, hard irregular intermitting pulse; with wide pupils, but there is not any vomiting. In concussion the body is cold, the breathing easy, the pulse regular and small; the countenance little

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(*a*) Mémoires, vol. iii. p. 322.

changed. Extravasation and concussion may occur together at the onset, or extravasation may accompany concussion.

[It is often very difficult to distinguish between drunkenness, and either concussion or compression; especial care should therefore always be taken to ascertain as far as possible the condition of the patient previous to the accident, lest he should be lost by too light consideration of his symptoms.

In persons of drunken habits *delirium tremens* may come on after concussion, as well as after any other accident. I have seen one example of this kind, but believe it to be rare. The treatment will require the closest attention, and the administration of opium is necessary as in other cases of the same disease.—J. F. S.]

422. Inflammation of the brain may be connected with concussion, and then the symptoms of oppressed sensation and motion may be accompanied with those of irritation. The pulse becomes fuller, the patient more restless, appears wild, is delirious, convulsions come on, respiration is slow and snoring, and subsequently symptoms of pressure on the brain ensue.

423. The changes produced on the brain by concussion are various, and may be divided into primary and consecutive. They consist either *in a sudden depression of the activity of the brain and nerves*, in which after death no trace of any mechanical injury, frequently only a sinking together of the brain, which does not completely fill the cavity of the skull, is found; or in *tearing of the vessels*, or even of *the brain itself*, and *inflammatory congestion* (1). In concussion the vessels of the brain are always more or less debilitated, so that, when the first symptoms of concussion have passed by, they cannot withstand the subsequent influx of the blood, and in this way gorging with blood and its effusion through the relaxed walls of the vessels takes place. In concussion of the brain there are, therefore, various conditions to be remembered, namely, *torpor* and *weakness of the nervous system*, *irritation and inflammation*, *extravasation*, and not unfrequently *concurrent affection of the liver*.

Dupuytren (*a*) distinguishes, in reference to these various changes of the brain, between *Commotion* and *Contusion;* the former he considers to depend on sudden depression of the activity of the brain and nerves, in which no trace of any injury can be discerned; the latter he holds as a similar change in the brain to that which occurs in bruises, viz., bruising, tearing, and extravasation of blood. The patient recovers from the symptoms; in the next few days inflammatory symptoms occur and cause death, as has been already mentioned in unfavourable inflammation of the brain. (*par.* 404–406.)

In tearing of the substance of the brain the symptoms should, according to Walther (*b*), come on at once and without remission, but continue till the setting in of encephalitis without increasing or diminishing. Only in a single case has Walther noticed a perfect intermission of the symptoms. The most constant symptoms are loss of consciousness, the deepest coma without possibility of wakening, convulsions, vomiting, subsequently palsy comes on, probably at first as a symptom of inflammation and perspiration. This statement does not concur with that of others. Astley Cooper (*c*) relates a case wherein, from tearing of the substance of the brain, no other symptom of brain affection except loss of speech occurred, and this came on after three days.

["With respect to the state of the brain under concussion, when the injury has not been excessively severe, it seems that the symptoms are merely the effect of a disturbance of the natural course of the blood through the brain. A fit of vomiting, by forcing the blood through the brain, will sometimes almost immediately restore the functions of the mind and body. It seldom happens that this state of the brain destroys; but when it does, nothing is found upon the examination which will account for the symptoms. It is therefore an alteration of functions, but not a disorganization. But when the concussion is very violent it is attended with lesion of the brain, with slight laceration of it accompanied with slight extravasation."—A. Cooper. (p. 262.)]

424. The causes of concussion are either shaking of the whole body (1),

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(*a*) Leçons Orales de Clinique Chirurgicale, p. 503. (*b*) Above cited, p. 70. (*c*) Above cited, p. 263.

to wit, by a fall upon the feet; or violence which strikes the skull itself and acts upon it to a certain extent. Most commonly in concussion the skull remains entire; it may, however, be injured in various ways.

[(1) **Astley Cooper** says:—"I have known concussion arise from the general shake of the whole body, unaccompanied by any blow upon the *cranium*, pain in the head succeed, with the usual symptoms of concussion, and the patient's life be greatly endangered." (p. 262.)

"A very curious example of pure concussion," quoted by **Hennen**, "is given us by **Schmucker** (*a*), in which a cannon-ball took away the queue from the nape of a soldier's neck, without injuring the integuments in any sensible degree. He continued in a complete state of stupor for many days, during which he was bled at least twenty times. Twenty-four grains of tartar emetic, given at short intervals, produced some stools, but no apparent inclination to vomit, after having suffered a relapse from having been moved prematurely on a march with the army." (pp. 318, 19.)]

425. The *prognosis* is guided by the degree and complication of the concussion. In its most severe form convalescence is always tedious, and there frequently remains disturbance of some of the mental faculties, loss of memory, weakness of sight, amaurosis, loss of smell and taste, great irritability of the stomach, and so forth. Complication of concussion with extravasation and inflammation always renders it extremely dangerous.

426. As to the *treatment* of concussion; this must be various, according to the different conditions of the patient (*par.* 426); as in concussion there is always gorging of the brain with blood, and subsequently attacks of inflammation to be dreaded, general and local blood-letting, cold fomentations, purging and irritating clysters are especially indicated. Large blood-lettings are in most cases fatal; small bleedings are to be made as often as the pulse again becomes hard; if, however, it becomes weak and intermitting, no blood must be taken away; nor at the onset, when the pulse is scarcely to be felt, the countenance is pale, and so on, is blood-letting to be used, but only when the pulse rises (1). Too frequent bleeding often brings on convulsions. If the patient be found in a weak state, if the pulse after bleeding become smaller and weaker, spirituous frictions, a blister over the whole head, stimulating clysters, vomiting with tartar emetic, should be employed, the latter, however, with the greatest caution, because if blood be extravasated, or there be disposition to apoplexy, the patient's condition is thereby considerably damaged (2). Stimulating remedies, as *arnica*, musk,* fluid alkalies, even wine as recommended by many, are, on account of the danger of subsequent inflammatory irritation, rather disadvantageous, and to be used only with especial caution.

[(1) I presume there is now scarcely a Surgeon who would take blood from a patient who was stunned, immediately after a blow on the head; a practice formerly advised, though in reality rarely carried into effect, as almost invariably some time elapses between the receipt of the injury and the arrival of the Surgeon. No bleeding must be resorted to till the constitution have recovered the shock; till the coldness has subsided, and the heart has recovered its power: to encourage which the patient should be quickly put to bed, bottles of hot water or heated bricks applied to his feet; and, if he be very cold, and his pulse weak and low, a little brandy with hot water should be at once given, and repeated if necessary. When the patient has been brought round, when the warmth is returned and the pulse is improved, the Surgeon must act according to circumstances. Bleeding is not always necessarily though it is generally required. But I do not think it advisable to bleed largely, although only at the first bleeding, as recommended by **Astley Cooper**; for, with the disturbed circulation in a brain labouring under concussion, a large bleeding may and in some instances will produce fatal fainting. The quantity of blood to be taken at the first bleeding, so soon as the quickness of the pulse requires it, which is generally in six or eight hours, but sometimes later, must therefore

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(*a*) Chirurgische Wahrnehmungen. Berlin, 1759. p. 393.

be proportioned to the patient's constitution and the condition of the pulse; and if even after a very few ounces only have been drawn the pulse should intermit, the bleeding should be immediately stopped, or fainting and convulsions will ensue. Five or ten grains of calomel should be given immediately, and the best mode of administering it is to mix it with a little sugar, or with a little honey, and put it on the tongue, so that it may gradually pass with the spittle, down the throat. If in the course of a few hours it have not operated, (and even if it have, there will be no objection,) a clyster of a pint of warm infusion of senna with Epsom salts, or castor oil in gruel, may be thrown up, which will at least empty the lower bowel, and often encourage the purging action above.

If the patient after some hours continue insensible, and congestion in the brain be presumed, or if inflammation have begun, then bleeding must be employed again and again, either generally or locally, or both, according to the severity of the symptoms. But above all calomel or mercurial friction must be employed till the symptoms yield, or till ptyalism is produced, and then sufficient only used to keep up that condition. If the treatment be successful the symptoms will gradually subside; but sometimes before this happens alarming fits of an epileptic character may occur, which happened to a young man under my care some years since, who, whilst labouring under inflammation after concussion, on the morning of the sixth day after the accident, had three such fits at intervals of two hours, became completely comatose, and had dilatation of the pupils; and on the following day had two more, so that I presumed effusion had taken place, and that he would die. Upon the eighth day, however, he began to answer questions, and on the thirteenth began to comprehend his condition; in the course of the day became perfectly sensible, and at last completely recovered.—J. F. S.

The quantity of blood which has been withdrawn, during concussion and its consecutive inflammation, is enormous. ASTLEY COOPER mentions an instance in which "the whole quantity of blood, taken by bleeding from the arm, opening the temporal artery, and the application of leeches, as far as this could be estimated, amounted to about two hundred and eight ounces; of which one hundred and eighty ounces were taken from the arm. * * * This gentleman recovered." (p. 272.)

(2) Vomiting with tartarized antimony, or any other emetic, should never be resorted to, as the effort to empty the stomach drives more blood to the brain, which is precisely contrary to that which is desired.—J. F. S.]

427. If the patient be improved by either of the prescribed treatments, he must long avoid every exertion and over-heating; if any palsy remain the employment of stimulating strengthening remedies, mineral baths, emetics, electricity, and so on, are useful. If the concussion be accompanied with fracture and impression of the skull, these must be first treated according to the rules already laid down.

428. In order to prevent the insidious inflammation of the brain, which often first arises some time after concussion, the patient must be closely watched, kept very quiet, cold applications, spare diet, purgings, tartar emetic in small doses, and long continued, must be employed, and the gastric symptoms especially looked after.

In order to get rid of the remaining consequences of concussion, cold washes to the head, washes with caustic liquor of ammonia and water, the application of *species cephalica* (a), blisters, often an issue upon the head itself should be used; in long-continued determination of blood to the head, repeated blood-letting and aperient medicines, with a properly regulated diet, must be employed.

D.—OF TREPANNING IN INJURIES OF THE HEAD.

429. The opinions of surgeons as to the application and necessity for the trepan in injuries of the head are very different. Some (DEASE, DESAULT RICHTER, ABERNETHY, A. COOPER, BRODIE, LANGENBECK, WALTHER, and others) considerably restrict, and only have recourse to it when the secondary symptoms of irritation and pressure have set in severely. Others

(a) Under this title are included several kinds of powders consisting of farragos of herbs.

(especially PETIT, QUESNAY, POTT, SABATIER, LOUVRIER, MURSINNA, ZANG, SCHINDLER, and others) apply the trepan more generally, do not restrict it to the appearance of secondary symptoms, but determine its necessity according to the injury which is always to be feared on account of the peculiar condition of the coverings of the brain. Trepanning is, in their opinion, a preventive remedy in most cases.

430. The reasons which the former surgeons offer in support of their opinion are :

1. Experience shows, that in fractures of the skull, with and without impression, under proper treatment, the cure very often takes place, as they are counterbalanced, or the brain becomes accustomed to the pressure. Trepanning should therefore not be performed before the most pressing symptoms of irritation or pressure require it.

2. The same applies to effusions of blood, the absorption of which experience also shows may take place.

3. Trepanning is an operation not free from danger; to the existing injury fresh violence is added, the result of which cannot be determined. A more especial ground of danger in the operation is, that the coverings of the brain are bared. If inflammation then ensue, the brain is thrust up into the opening, the *dura mater* ulcerates, fungous excrescences (1), and so on, protrude; this occurs particularly in children, in whom the *dura mater* is firmly connected with the skull. (ABERNETHY.)

[(1) Fungus of the brain, after trephining, is not within my knowledge of so frequent occurrence as ABERNETHY's observations would infer. I have seen and operated on several cases of compound depressed fracture of the skull, and can scarcely recollect an instance of fungus, when the operation was performed early and the *dura mater* was uninjured. The fear of it, therefore, should not deter the surgeon from using the trephine in compound fracture.—J. F. S.]

431. To these objections it is replied, that the condition of the internal table of the skull, which is fragile, brittle, and glasslike, renders the fracture in it of greater extent than in the outer table, and that it spreads in a radiated form, and is accompanied with splintering; that in these injuries the vessels connecting the *dura mater* with the skull are torn, and that effusion of blood will occur. If it be remembered that in sabre and shot-wounds these conditions must be so much more certainly present, that in all these injuries the *diploë* is so bruised that inflammation and suppuration must occur, so it must be perceived that the absence of pressure and irritation can afford no certainty, as if these have once set in. the brain and its investments are already so decidedly diseased that trepanning can be rarely considered as a means of cure. The same happens also in employing the trepan in extravasation of blood. If the surgeon, in expectation of absorption in these cases, delay trepanning till the symptoms have arisen to a high degree, is it not then to be feared that, on account of the active inflammation of the brain and its membranes, perhaps even on account of the putrid state of the extravasated blood, little more can be done by trepanning? They cannot deny that fractures of the skull with and without impression have been cured without trepanning; and it may be even added, that of ten cases which were trepanned, under the above-mentioned circumstances, in two the operation was perhaps unnecessary (which, however, could not have been previously determined.) But if the patient be trephined upon the appearance of the consecutive symptoms, the result will be unsatisfactory in most cases. Trepanning is not to be considered in itself as a

dangerous operation; it is so esteemed because most commonly it is only employed when the diseased changes have already become great, or severe injury has been produced by the external violence.

Besides the writers already mentioned, the following may be also compared:

HENKE's Zeitschrift für die Staatsarzneikunde, 1824, part i. p. 166.

KLEIN; in Heidelberger klinischen Annalen, vol. i. part i. p. 86.

TEXTOR; in Neuen Chiron., vol. ii. part ii. p. 381.

432. If we compare these various principles which have been advanced as to the necessity of trepanning in injuries of the head, and consider them, unreservedly, according to the result of the experiments upon this important subject which have of late been made with the greatest care and attention; if we consider that the treatment of wounds in general, as well as that of wounds of the head, has become more simple and satisfactory, we cannot agree to so extensive an employment of the trepan. Experience has satisfactorily proved that *simple fissures* and *fractures of the skull*, in most cases, occur without the severe injury of the neighbouring parts which has been said to be generally therewith connected, and that the consequences thereto ascribed may, by proper treatment, be prevented. If in such injuries trepanning be employed as a prophylactic, it certainly, in most cases, only renders the state of things worse, and the proportionate needless use of the trepan is proved to be much greater than POTT and ZANG have stated. If the danger of trepanning has been estimated by many too highly, on account of the wound inflicted by it, and for this reason its application has been too much restricted, it is not, however, to be denied, on the other hand, that it has been too lightly thought of, and such a mode of performing it recommended as must inflict an injury out of all proportion to the accident for which it was undertaken; for instance, ZANG's practice, in penetrating fissures and fractures, of applying the crown of the trepan as frequently as requisite to take away entirely the fissured or fractured bone. The same also holds in reference to the *bruising of the diploë*. Severe bruising of the *diploë* may, without doubt, be extremely dangerous in its consequences; but, how can it be distinguished whether there be not also injury of the bone? The severity of the injuring violence is, indeed, an important circumstance in determining the danger of injury of the head; but experience shows, in this respect, so different effects and so different relations in respect of the skull, in each individual, in no way manifested in the former known condition, that it cannot be ventured to decide according to any definite scale. But, on the other hand, it is also equally improper to restrict the use of the trepan too much; for instance, not to apply it in fractures with impression, or only when these are connected with wounds, or with symptoms of compression of the brain; or in extravasation to do nothing, because the possibility of absorption cannot be denied, or the determination of its seat is often difficult, and frequently not possible with certainty.

[The propriety of applying the trepan and under what circumstances has been already necessarily discussed in considering the treatment of fractures with impression (*par.* 395); of separation of the sutures (*par.* 396); and of wounds of the brain into which foreign bodies have been admitted (*par.* 399.) It is not therefore necessary to recur to these points.—J. F. S.]

433. The trepan should be only employed for the removal of decidedly dangerous conditions in injuries of the skull, which are certainly known, and of which it may be assuredly foretold that they will produce symptoms

dangerous to life; and, if these have once set in, the operation will not longer have a satisfactory result. If, also, certain injuries of this kind be cured without trepanning, it must not mislead to the supposition that the trepan is useless or superfluous; the question is not, whether, in certain cases, a cure may not be effected without the trepan, but whether the trepan is the most proper and certain remedy for the restoration of the patient.

As I was formerly a defender of the more extensive prophylactic application of the trepan, but from the result of careful observation and experience have withdrawn from it, the opinions here brought forward may be so much the less the object of doubt.

434. Upon the following grounds trepanning is to be considered as indicated, indeed, immediately required, without secondary symptoms:

1. In fractures of the skull with impression.

2. In fractures of the skull, with splinterings of the bone, directed against the *dura mater;* for instance, in fracture of the frontal bone, in wounds inflicted with blunt swords, in stabs, in shot-wounds, and so on.

3. In separation of the sutures.

4. In cases where foreign bodies have penetrated from without into the cavity of the skull.

For these cases the trepan may, however, be unnecessary, if the condition of the bony walls and the separation of their edges permit the removal of splinters and foreign bodies, and, if in separation of the sutures, the escape of the extravasation and of the secretion of the wound from both sides be allowed; or when a piece of bone can be entirely removed, and no further splintering exists.

435. In the subsequent course of injuries of the head, trepanning may be necessary:

1. In fracture of the skull, with symptoms of compression, when they continue after bleeding and proper treatment.

2. In extravasations of blood, if the symptoms be not diminished by energetic and proper treatment, if it be certain that the violence have operated on one particular part of the skull, namely, at the course of the middle meningeal artery.

3. When, notwithstanding proper treatment, symptoms of inflammation of the brain continue, connected with those of pressure, especially when a circumscribed painful tumour rises, in opening which the *pericranium* is found separated; or the bared bone shows a grayish colour, and its texture is changed.

4. When the secretion of the wound cannot properly escape from the wound in the bone, when the *dura mater* is separated to a greater extent, and there is also a collection of pus (1).

5. In caries and necrosis, with separation of the *dura mater*, and collection of pus between it and the skull (2).

6. In continued severe headache, with convulsions or epileptic symptoms, which decidedly arise from the place of the earlier injury (3).

[(1) Of these also have been considered already, compression from depressed fracture (*par.* 395); from extravasation of blood (*pars.* 432, 33); and from collections of pus (*par.* 387.)

(2) With regard to trepanning in cases of caries and necrosis, unless symptoms of compression have come on, which is not of very frequent occurrence, it is better to leave them alone, taking care, however, when pus collects beneath the scalp and cannot readily escape, which in these cases happens again and again during the course of the natural cure, that it should have a free outlet by cutting freely through the skin. From time to time a careful examination should be made to ascertain if the dead bone be loose,

and when this appears to be the case it should be gently lifted with an elevator, and drawn out with a pair of forceps; and if it run far beneath the scalp, as it often does, it is then best to cut through the skin, and lift up the flaps, by which means the removal of the dead bone is rendered much easier. In this way I have successfully treated a woman with necrosis of the skull, probably from venereal cause, and removed the upper half of each parietal bone, partly their whole thickness, partly only the external table, at two several times, and also portions of the occipital and frontal bones at other times, without the slightest inconvenience. And when these had been removed the exposed internal table and *dura mater* were found covered with healthy granulations, which soon coalesced with those on the under surface of the scalp, and where the latter was destroyed, united by a large intervening scar. The same result also follows the removal of bone which has been destroyed by violence, when the irritation of the brain and its membranes has been quieted.—J. F. S.

(3) The preparations from the two following cases are in the museum at St. Thomas's Hospital. The first related by Dr. WELLS (*a*) exhibited the usual symptoms of epilepsy; but the second, for which I have to thank my friend GREEN, has rather a cataleptic character.

CASE 1.—T. H., a negro sailor, aged about eighteen years, was admitted into St. Thomas's Hospital, November 15, 1804, for paralysis in his left limbs, and being subject to convulsions, both of which he says attacked him four years since, having been struck, a short time before, with the claw of a hammer on the right side of his head. On examining his skull a short narrow chink was found on the right parietal bone, into which the edge of a shilling could just be inserted. It was therefore determined to trephine him, though he had not had any convulsions whilst in the hospital; indeed he said they did not attack him except he was put in a passion. The operation was performed by BIRCH, in the beginning of December, and the piece of bone in which was the chink, removed. Great difficulty was experienced in raising the bone which appeared to be held by the *dura mater*, and whilst this was being effected the patient had a severe epileptic fit. A little spur of bone, about the eighth of an inch in length, descended from the under surface of the bone, and seemed as if it were the piece driven down from the short narrow chink, of which there was still some appearance. The *dura mater* upon which this little spur had pressed was thickened around it. The convulsions continued to harass him frequently for nearly a fortnight. Before the wound in his head was healed, his master being about to sail for the West Indies, took him from the hospital. His palsy was then somewhat less than it had been before the operation. He returned to London about ten months after. During his absence he had grown both taller and stouter; the limbs too of his left side had become stronger, but they were still much weaker than those of the right, and he was still liable to convulsions when his anger was excited.

CASE 2.—A. B., aged seven years, a very pale-complexioned girl, but said to be very healthy, was admitted into St. Thomas's Hospital,

Feb. 10, 1841; and the following account is given of her. On the 13th of May, 1836, she fell down from a second-floor window upon the curb-stone, and when raised up was senseless, and appeared as if dead. She was taken to St. Bartholomew's, where it was ascertained she had an extensive fracture of the right parietal bone, but without any external wound. She remained insensible for twelve hours; but by the application of leeches and cold lotion she got better, and left the house seemingly well at the end of a fortnight. She remained well for two years and a half, complaining only of headache when the heat was very great. After this period she had a fit commencing with giddiness; she looked very silly, and walked round the room several times, generally repeating the last words she had heard or said. This was followed by rigidity of the muscles, principally of the right arm and leg, and of the right side of the face, and the corner of the mouth was drawn down. If she had anything in her hand and the arm were flexed, she would drop it, but the arm remained fixed in the same position. The fit lasted about three minutes, after which her senses returned all at once, and she would ask for anything she had before its accession, or resume her previous employment. At first she had only one fit a day, afterwards seven, and then one every hour, and in this condition she remained for three months. After this time the character of the fits changed; they came on with violent spasmodic contractions of the limbs and contortions of the face, without any silliness, but suddenly, and she would fall backwards. After the convulsions her right arm and leg would be useless, and seem as if dead. Of these fits, which continued to recur for two months, she had three, four, or seven a day, each generally lasting about five minutes, but the last affected her for several hours.

(*a*) Trans. of a Society for the Improvement of Med. and Surg. Knowledge, vol. iii. p. 91.

Leeches, warm bathing, and other remedies were employed; and for the next seven months she did not have a fit, but enjoyed good health, and grew rapidly. On the lapse of this interval she had a fit exactly like the last, but the left arm and leg were affected in the same manner as the right arm and leg had been in the first attacks. These recurred sometimes twenty times, sometimes only a few times a-day, and occasionally a day passed without any; and they continued for four months and a-half, during the last fortnight of which a swelling was observed on the right side of the head over the seat of injury; this, on the application of leeches, subsided simultaneously with the cessation of the fits, which did not recur for a twelvemonth. But in October last she was again seized with the same kind of fits as in the first attack, and both sides were now affected with rigidity.

At the present time she has three or four spasmodic fits a-day; and on some days a fit, accompanied with rigidity, every hour. She often complains of headache and giddiness; and when the fit is coming on the skin assumes a purplish appearance; she becomes very cold and trembling, and is often very mischievous and destructive. While taking these notes," observes Will. Adams, who reports the case, "she stood by me; suddenly her eyes were fixed, the pupils were dilated, and staring wildly at the opposite wall; her naturally very pale face became still more pallid; the lips were separated, the corners of the mouth drawn up as if laughing, and the teeth closed. The right arm was bent, the fist clenched, very firmly drawn against the side, and the hand extremely cold. The left arm was very slightly affected. She retained this posture and expression of countenance; but thinking she might fall, I sat her upon my knee, and immediately the left leg was firmly bent upon the thigh. It was impossible to bend the head either forwards or backwards, or to rotate it. The pupils, at first dilated and fixed, after two or three minutes suddenly contracted, but again expanded slightly. She then winked for a few seconds, gave a sigh, and returned to a state of consciousness, appearing as if nothing had happened to her, but only being very cold. The mother says she generally sighs very heavily at the end of the fit. She is aware of the approach of the fits, and lies down on her bed a minute or two before the attack. They last about three minutes; some parts of the body are slightly convulsed, while others are very rigid, the rigidity being always prevalent. On examination of the head there is perceived a broad fissure in the skull extending from about the centre of the sagittal suture obliquely across the right parietal bone to the lambdoidal suture, the integuments over which rise and fall with the pulsations of the brain."

Feb. 12. She had two fits. 16. One. 19. Two. 20. One; as also on 26, 27, and 28*th*.

March 2. Two. 9. One. 10. One. 11. Two more violent than usual. 12. One. 16. Three.

Green considered that the cause of these curious symptoms was depressed bone, and therefore determined to trephine her.

March 20. A ⊥-shaped incision was made through the integuments, the horizontal stretching obliquely across the hinder upper part of the right parietal bone, and the vertical one across the fissure. The flaps were then raised, and a triangular portion of bone being exposed, the crown of the trephine was applied just above the fissure where the bone was irregular. On the removal of the trephined bone a lacerated hole was found in the *dura mater*, but *no dura mater* adhering to the under surface of the bone, or rather the *dura mater* was deficient. A probe was then slipped in, and passed beneath the edges of the fissure, but no depression could be felt. The arachnoid coat and *pia mater* were then cut through, for the purpose of exciting inflammation between them and the *dura mater*, to shut off the wound from the general cavity of the latter; and this done the flaps were laid down, a piece of lint wetted in cold water laid over, and the child put to bed. One vessel bled very profusely during the operation, but she had not any fit.

On the following afternoon at half-past 4 she had a fit, and another four hours afterwards. A dose of scammony and calomel (15 grs.) given in the morning not having acted, an injection of castor oil and gruel was administered at night.

She was kept on tea and toast and water till the 24th, when no inflammatory symptoms having appeared she was allowed a cup of beef tea. On the 26th having had a bad night she was restless and irritable. On the 27th the bowels not being open, fifteen grains of scammony and calomel were ordered, which freely relieved them.

March 29, *half-past* 2, P.M. She had a fit attended with violent spasm of the muscles of the lips, lower jaw and eyelids, and biting of the tongue, so that blood flowed from the mouth. The dressings were now first removed; the edges of the wound were separated and lifted up by a swelling rising above the level of the skin, part of which resembles brain, but most of the surface is covered with blood and pus. The child was sufficiently sensible to wipe her mouth, and to push away the hand of any one who touched her; but the fit continued for three hours. She was ordered twelve grains of scammony and calomel forthwith. During the night she had three shivering fits.

March 30. From *half-past* 8, A.M. till 10, A.M. she was insensible, did not seem to feel when pinched, and moved only twice during this time. At 10 she spoke. At noon as the powder had not acted, an injection was given, which relieved the bowels, but not sufficiently, and therefore the powder was repeated. As she seemed low, eggs and arrow-root were ordered. During the night she had a slight shivering fit; and on the following day became very irritable.

April 1. Has passed a good night, but has had five shivering fits; has taken little nourishment; continues exceedingly irritable. The pulse which has not altered much in the last few days, is small, quick, and weak.

April 3. Lies in an unconscious state, breathing quickly, and refuses food. On the following day she was in the same condition, but frequently screamed out, and her breathing was sonorous. She continued sinking, and, *April* 5, at 2, P.M., she died.

Upon examination a protrusion of the brain of the size of a walnut passed through the trephine hole. In removing the *calvaria* two drachms of pus escaped, and when it was taken off the *dura mater* was found deficient throughout the whole length, and on each side of the fissure, so that the gap in it was about four inches in length and one in width. Lymph had been deposited between the membranes, and in front of the gap there was one small cavity, bounded by adhesions, and containing about two drams of pus, and another between the gap and the inner edge of the right hemisphere, containing about a dram and a half, both causing irregular depressions of the brain without any ulceration or morbid state of the arachnoid. The vessels of the *pia mater* were much injected. Upon the posterior lobes of the *cerebrum* were some old adhesions, and also between both hemispheres in front. Upon the *tentorium* was some soft lymph, and much on the right side of the *falx*. In both ventricles there was serum, but most in the left, and the hind wall of the right was remarkably tough, resembling a piece of chamois leather soaked in water. At the bottom of the skull there about two ounces of serum and lymph.

My friend GREEN has also mentioned to me another case, at the operation for which he was present.

CASE.—A young man became insane after a blow upon the longitudinal sinus. No depression existed, but as the spot where the injury had been received was known it was determined to try the effect of removing the bone; and he was accordingly trephined by the elder CLINE; but no irregularity was found on the under surface of the bone. In the course of the operation the longitudinal sinus was wounded, but the bleeding was easily stopped by slight pressure. The insanity ceased so long as the wound remained unhealed; after which it returned. But ultimately the patient got quite well.

The following extraordinary case occurred many years since in St. Thomas's Hospital, of which the following brief account is given by ASTLEY COOPER:—

CASE.—A sailor was admitted in May, 1800, who had a depression near the upper edge of the left parietal bone. He was in a great degree destitute of sensation and voluntary motion; his pulse regular; his fingers continually and alternately closed and opened, nearly in corresponding frequency with his pulse. When hungry he ground his teeth; when thirsty sucked his lips; and when he wanted to void his stools or urine he moved about in his bed, but would sit on the chair to pass them. He was trephined by the elder CLINE. During the operation he made a complaining noise; the motions of his hands ceased; and the pupils of the eyes were directed forwards. Three hours after he was found raised in bed, and when asked if he were in pain he put his hand to the wound. The next day, though he still remained stupid, he could answer "yes" or "no." He ultimately recovered, and when asked what he knew about the accident, he said, the last thing he remembered was being engaged in taking a prize in June, 1799; but nothing further was ascertained, except that he had been first taken to Gibraltar, and then to Deptford from whence he had been brought to St. Thomas's; and during the whole period his mental faculties and his bodily powers were suspended. He got perfectly well.]

436. In cases of necessity every part of the skull may be trepanned, although we carefully avoid when we can *the frontal sinuses*, *the middle of the frontal*, *the scaly part of the temporal*, *the lower front angle of the parietal*, and *the crucial ridge of the occipital bone*, and also *the sutures*. The choice of the part for the application of the trepan is in every case

directed according to the difference of the object to be attained. Therefore, in extravasation, that part is to be trepanned where the already described symptoms are supposed to have their seat; in fractures of the bone, so upon its middle that the pyramid of the trepan stands on one side of the fracture; in fracture with impression, on the edge of the impression, but so that the crown plays upon the edge of the fracture; in small fractures or balls driven in, the whole may be surrounded with the trepan crown; in injuries on or into the sagittal and lambdoidal suture it must be applied on both sides. The number of applications of the crown cannot be predetermined; they must be repeated till all the extravasation be perfectly removed, pressure removed without violence, and splinters extracted.

437. Trepanning is divided into the following acts :—1, *laying bare the bone; 2, perforating it; 3, elevating the piece of bone;* and, 4, *the various particulars necessary for the attainment of the object.*

438. As the kind of injury to the soft parts varies, and the number of applications of the crown of the trepan cannot at the first be determined, the following general rules only can be given for laying bare the bone. The coverings of the skull are to be preserved, because thereby the scarring is promoted, although many object to flap-cuts because they are in the way, during the operation, and crumple together subsequently in the dressing. Upon the temporal bone a flap of the temporal muscle is to be made with its base above. If it be presumed that one crown will suffice, a simple long cut may be made, of which the edges are to be separated. For several crowns, a + or T-shaped cut should be made, the flaps of which must be turned back. The head of the patient should be placed opposite the light on a solid table; the knife so held in making the incision that its edge should always be vertical, and the hand supported either on the thumb or little finger. The bleeding must be permitted to continue, because thereby the symptoms are often diminished; it is to be stanched by rubbing the mouths of the vessels with cold water, or by tying them. The *pericranium* should be scraped off with the scraper from the circumference to the centre of the space to be cut through by the application of the trepan, and removed.

439. The *penetration of the bone* is effected either with the *improved arch-trepan*, or with the *hand-trepan* (*trephine.*) The application of the latter is more simple than of the former, but more wearisome for the operator.

The perforation of the skull is effected more easily and more certainly by B. HEINE'S bone-knife (*osteotom*); inasmuch as with it an opening corresponding to the object of the operation may be made at pleasure into the skull; the *dura mater* is less liable to injury, and it is unnecessary to suspend trepanning for the purpose of cleaning the saw-teeth from the bone-dust; the sawing-through is also accompanied with less shaking.
Compare VON GRAËFE and WALTHER'S Journal, vol. xviii. p. 39.

440. In using the arch-trepan (1) the following method is adopted: after properly clearing the bared bone, the pyramid or pin of the trepan crown is to be put a little over the edge, held firm, the crown attached to the arch, in the under part of which it is held like a feather, the pyramid fixed on the middle of the exposed part of the bone, and the trepan brought completely vertical. The left hand lies flat on the disc of the arch, the right grasps the handle. The trepan is now to be turned round from right to left rather quickly, and until it has sawn in a sufficient deep groove for the certain guidance of the crown without the pyramid. The trepan is to be

then raised, the groove cleared, with a pencil of charpie, from the saw-dust, (an assistant purifies the trepan with a brush,) and an opening is to be made by the *tirefond* (2) into the pit formed by the pyramid; the trepan is then to be replaced in the former groove, and its pyramid having been retracted, is to be brought into the vertical position, and to be again moved round quickly, the left hand pressing on the disc till it is presumed to have penetrated the *diploë*. The crown is to be again removed and cleaned by an assistant, and after the track has been again cleared of saw-dust, its depth throughout the whole extent is to be ascertained by a chisel-shaped probe, or by a feather stem cut for the purpose. The trepan is to be again replaced; the pressure is to be somewhat moderated, the trepan to be turned less quickly, and more to that side where the groove is shallower. The trepan is to be again raised and cleaned, and the depth of the groove examined. If it have not yet penetrated the bone, the crown must be again set on, turned round a few times, with slight pressure, then removed, and the groove again examined. Thus is it proceeded with till the groove has penetrated in several places, and the piece of bone seems movable when pressed with the nail of the left fore finger. In perforating the inner table of bone a peculiar crackling is heard.

[(1) The trepan which was employed by Surgeons of the olden time, both in this country and in France, but which, from CHELIUS's directions for its use, does not appear out of date in Germany, consists of a crown and pyramid or pin, much like that of the trephine now in common use, except that the stem of the instrument is not fixed in a cross handle, but in a stock similar to that used by carpenters in working a centre-bit, and turned round spindle-ways like it. The improved instrument of which CHELIUS speaks has the stem work through an arch, of which the legs rest on the skull and render the movement of the crown more steady. The trepan has long since been laid aside in this country. It is highly objectionable and dangerous, on account of the utter incapability of nicely moderating the pressure necessary for its use, and which is easily managed by the trephine.

(2) The *tirefond* is a kind of steel screw, with a single or double thread at one end like the screw point of a gimblet, and a ring handle at the other. Its point being put in the pit formed by the pin of the trepan, is turned round till it is fixed firmly in the trepanned piece of bone, which is then lifted out by pulling up the ring handle. This instrument, as well as the trepan, has been entirely out of use for many years in this country; the trephined bone being raised by the elevator presently to be described.—J. F. S.]

441. In perforation with the hand-trepan (*trephine*), it is to be so held, after the pyramid or pin has been properly pushed down and fastened, with the right hand, that the thumb is placed on the one, the middle, ring and little finger on the other side of the handle, and the fore finger along the stem touching the top of the crown: the pyramid is to be fixed on the middle of the piece of bone to be perforated, and the crown moved, after being brought into a vertical direction, corresponding with the surface of the bone, in alternately contrary semicircular turns, with the upper and fore arm held steady, and the hand alone moving, till a sufficiently deep groove is formed for the further direction of the trephine. The instrument is then to be withdrawn, cleaned, the pyramid retracted, a sufficient opening made with the *tirefond*, and afterwards is to be managed as has been already mentioned in reference to the arch-trepan.

[The trephine has with us entirely superseded the trepan, and except in rare cases of fracture with depression, or in making openings into the skull when no depression exists, has itself also given place to HEY's saw. The pyramid, pin, or, pivot, is made to travel up and down in the stem of the English trephine, and is capable of being fixed with a screw at any length within the cavity of the instrument, or projected beyond the plane of its cutting edge. In commencing the operation the pin is fixed projecting beyond the plane of the trephine, and its point being placed on the skull is made to descend into its substance by alternate contrary turns of the handle of the instrument, till the toothed edge of the crown, which moves round it, begins to bite and cuts a track for itself sufficiently deep to prevent its slipping out, when the pivot is retracted into the stem of the instrument, which is necessary, as it being longer than the crown of the trephine, it would penetrate the skull before the crown of the trephine, and make a wound in the *dura mater* and brain, an accident which, from gross carelessness on the part of the operator, I have once witnessed.

As soon as the trephine has worked a track sufficient to retain it in place, an examination of the track should be made with a thin-eyed probe to ascertain whether the skull be penetrated, and at what points. This is a most important step in the operation, for as in adults the thickness of the skull varies considerably in different individuals, and even in different parts of the skull in the same individual, and as in elderly persons it is *often* thin, and in children *always* thin, and still thinner the younger the child is, so unless the depth of the trephine-cut through the skull be ascertained, the bone may be cut through at one or other part of the trephine-track, and the membranes below seriously torn, or even cut through, and the brain itself injured. In proportion as the trephine-crown descends into the bone, the pressure made on its handle in working it, is to be diminished, or otherwise the Surgeon will, to his dismay, and the great danger of his patient, find the crown suddenly descend, all resistance cease, and that the *dura mater* and brain are torn. This too I have seen happen. It must, therefore, be remembered that in both young and old persons, and in the former especially, the trephine is to be handled with only sufficient pressure to make its crown cut.

When the crown is found to have descended so low that there is reasonable expectation that the internal table of the skull is on the point of being cut through, or when, by examination with the probe, it is found to have been cut through at one or more points, the edge of the elevator is to be carefully introduced into the trephine track, and the piece of bone included within the latter gently prised up, which is easily done if the remainder of the unsawn inner table be very thin, and it then yields with a crack and is lifted out. If, however, the remaining unsawn part will not yield, the trephine must be again applied with a light hand, and the examination with the probe repeated. If the bone be sawn through at one part of the track, but the other part will not break with such justifiable force as can be applied with the elevator, the sawing must be resumed, but with the trephine tilted, so that it shall act only on the part not cut through; and this is to be repeated again and again, with intermediate examination with the probe and repeated attempts with the elevator, till the trephined piece of bone can be separated.

In adults the detached bone is generally lifted off the *dura mater* without difficulty, and always easily if blood or pus be poured out between that membrane and the skull. But in young persons, and children especially, this is not the case, for the numerous vessels at that age passing through the skull bones, from the *dura mater* to the *pericranium*, and in the contrary direction, hold it, like hooks, very tightly, and offer so great a resistance to its removal as often to lead to the supposition that the separation from the adjoining bone is not complete. This is a very important point, and cannot be too carefully remembered.

It must also not be forgotten that, in operating for depressed fractures of the skull, the trephine is applied not on the depressed portion of bone, but on the neighbouring part, which retains its natural place, to form an opening through which an elevator may be introduced beneath the depressed portion, for the purpose either of raising it to its proper level, and relieving the brain from pressure, or for taking it entirely away, if it be detached as well as driven in. Therefore the operation is not concluded by removing the trephined piece, but only the preliminary step taken to the actual object of the operation, to wit, the raising of the depressed bone, which is to be done by carefully passing the elevator through the trepan hole, and insinuating it between the *dura mater* and the depressed piece; which done, either the finger of the left hand or the edge of the trepan hole is to be made the fulcrum on which the elevator rests, whilst its handle being depressed, the point rises and lifts up with it the depressed bone to its proper level.

If, after thus doing, the fractured bone be only loosely connected or entirely detached, or if several pieces be broken and thrust in the *dura mater* and brain, it is best to remove them either with the elevator alone, or with a pair of forceps, as may be most convenient.—J. F. S.]

442. In cases in which the pyramid cannot be at first used to direct the crown, as when balls are driven in, or pieces of bone entirely broken off,

which can be completely surrounded by the crown, a disc of sole leather is employed for the more perfect direction of the crown, with an edge so broad that the finger point of an assistant may fix it properly. In the hollow of this disc the crown is placed, and carefully directed till it have formed a sufficient groove, when the disc may be removed. The piece of bone is to be raised with an elevator, or with a pair of pincers.

Hennemann (*a*) proposes a crown director instead of the pyramid for a more perfect guidance of the crown.

443. If it be necessary to trepan on the frontal sinuses, the instrument must be so arranged that it shall come at the same time on the deep part of the frontal sinuses, where the anterior is farthest from the posterior bony table, as upon the inner table above, and thus perforate it at the same time; or the external table may be first cut through with a large crown, and removed, and then the internal perforated with a smaller one.

[Trepanning on the frontal sinuses, at least in civil practice, is rarely necessary, The usual blows from falls, or with blunt or even sharp instruments, rarely causing depression of the inner table of the skull, and therefore not producing compression of the brain, nor requiring operation. Should, however, such a case happen, I should prefer Chelius's second mode of treatment, to wit, removing first the outer and afterwards the inner table.—J. F. S.]

444. For the purpose of *taking out the piece of bone* the *tirefond* is to be screwed into the hole made for it (*par.* 440); it is to be held with the thumb and fore finger of the left hand close to the edge of its screw, and to be turned about with the same fingers of the right hand at its handle. When the *tirefond* is sufficiently screwed in, (without injuring the *dura mater*,) the piece of bone can be raised from that side where it is still fast. If any irregularities or splinters remain on the edge of the internal table they must be removed with the lenticular, which must be held with the whole hand, its head placed between the skull and *dura mater*, and its edge pressed against the pieces of bone to be removed. The thumb must be set against it to render this motion safe.

[The mode of removing the depressed and detached bone has already been mentioned (*par.* 441.) If any points remain projecting from the edge of the fracture, they may be removed either with bone nippers or with Hey's saw, a spatula having been previously introduced between the bone and *dura mater*, to defend the latter from injury. The lenticular is never used by English surgeons.—J. F. S.]

445. If several crowns are applied (1), it must be so managed that either a fracture of different width should remain between two openings, and which may be taken away, either with bone-nippers or with Hey's saw, or if a piece, not directly corresponding to the crown of the trepan, is to be perforated, the crown must be so placed that it shall play over only half of the already existing opening (2). It is also advised, for the purpose of not always removing round pieces of bone, to take away, with Hey's saw, an irregular piece of bone, proportioned to the injury.

[(1) It very rarely happens, so far as I have had opportunity of observing, that in depressed fracture the application more than once is requisite. I have, however, in a very few instances known it needful to apply it a second time; perhaps it might have been from the first selected spot having been chosen with insufficient judgment, or perhaps that the depressed bone was so circumstanced that it could not be raised without simultaneous elevation at both sides. The rule, however, should be to make as few trephine holes as possible, so as to avoid increasing the quantity of exposed *dura mater*. And, if practicable, no undepressed bone, in case of fracture, should be removed.

(*a*) Beiträge zur Medicin und Chirurgie, vol. i. part i. p. 145.

(2) If the edge of the fracture be regular and without any corners, there is no choice, if it be determined to raise the depressed bone, but to apply the trephine on the undepressed edge. But if that edge present any angle at which the elevation may be conveniently effected, then **Hey**'s saw is preferable for its removal, as being most manageable, and less likely to injure the *dura mater*, more especially, if the depressed bone have descended so low that the whole thickness of the skull is exposed, or if a spatula can be insinuated between the *dura mater* and the portion of bone to be removed.—J. F. S.]

446. After the performance of the trepan the further treatment depends upon the circumstances it indicates.

The extravasation must be removed by a proper position of the head, by sopping it up with a moist sponge, or with charpie, when it lies beneath the skull. If the place of the extravasation be not hit, the circumstances already mentioned (*par.* 415) must determine the surgeon whether the operaation is to be repeated at some other spot. If the extravasation be beneath the *dura mater*; if this be thrust up into the hole in the bone, fluctuating and violet coloured, it must be divided with a cross cut. Bleeding from the middle meningeal artery must be stanched by pressure, with a bundle of charpie, with a ball of wax, or with a proper compressor, (**Faulquier**'s (*a*) or **Graefe**'s) (*b*), or by cauterization with a red hot pin. The bleeding from a wounded sinus is to be stanched with dry lint and a proper degree of pressure.

A piece of bone completely broken off must be removed with care. Impressed fractures must be raised with a simple elevator, the one end of which is to be introduced under the depressed piece of bone, the other held with the right hand, and depressed, whilst the fore finger of the left hand is placed on the edge of the trepan opening, and the elevator rested upon it. Splinters which are thrust into the membranes, or enter the brain itself, must be withdrawn with care, and without violence; if they be firmly fixed, the opening of the *dura mater* must be enlarged.

[The mode of treating extravasated blood has been already spoken of (*par.* 419, *note* 2.)

Bleeding from the meningeal artery, as far as I have had the opportunity of observing, never requires pressure, beyond a minute or two with the finger, but commonly not even that, as in general the bleeding ceases when the clot has been completely removed, as I have mentioned above. I should certainly never think of applying the actual cautery.

Slight pressure will generally stop bleeding from a sinus.—J. F. S.]

447. The dressing after trepanning is as simple as possible. A mass of charpie, smeared with mild ointment, is to be placed between the edges of the wound in the skin, so that, without pressing the membranes of the brain, it lies at the edge of the aperture in the bone; this is to be covered with a thin compress, and the whole retained in its place by a triangular head-cloth or a bandage (1).

The healing of a trepan-wound by quick union, after the removal of all foreign bodies, proposed by many, is not advisable. The experiments upon the replacement of perforated pieces of bone and the cure of wounds by quick union, prove indeed the possibility of the union of pieces of bone again replaced; but the danger that the replaced piece will not heal, but, as a foreign body, produce irritation, inflammation, and suppuration, is certainly as great if not greater than the probability that the healing will be rendered quicker and more sure thereby. This replacement of the piece of bone can specially only be attempted when an uninjured skull has been trepanned and nothing found beneath it.

[(1) The practice here recommended by **Chelius** should on no account be followed;

(*a*) **Perret**, L'Art de Coutelier, plate cxxxv. figs. 21, 22.

(*b*) **Hufeland**'s Journal der praktischen Arzneik, vol. xxvii. part ii., xxxi. p. 35.—Ibid, vol. part ii. p. 35, plates i. ii. **Ferg** zur Lehre von der Trepanation; in von **Graëfe** und **Walther**'s Journal, vol. ii. p. 576, and the Supplement to this paper by **Sich**, ibid, p. 592.

as the introduction of lint or charpie will necessarily prevent any union by adhesion, which it is always highly necessary to promote, and which, unless the scalp be very severely bruised, will commonly take place throughout the greater part of the wound. It is much better to lay the flaps down over the aperture in the skull, and apply two or three narrow strips of adhesive plaster so as to keep them in place, with room between to allow the escape of any bloody or serous oozing. No other bandage or compress, or, if any, only a single turn of the former should be applied, so as to avoid the least pressure on the exposed brain; and if there be much contusion, a thin light bread poultice between muslin, so that the crumbs should not get into the wound, should be applied.—J. F. S.]

Merrem, Animadversiones quædam Chirurgiæ Experimentis in animalibus factis illustratæ. Giessæ, 1810.

Walther, Ueber die Wiedereinheilung desbei der Trepanation aus geborhten Knochenstückes; in the Journal für Chirurgie und Augenheilkunde. Vol. V. Part IV.

448. In the general *treatment*, after the operation, bleeding, cold applications, purging must be employed, according to circumstances, for the purpose of preventing or putting aside the inflammation; and the patient must preserve the strictest quiet.

449. The dressings must be replaced once or twice a day, or as often as the discharge renders it necessary. If no particular symptoms come on after trepanning, the *dura mater* gradually loses its glossy appearance, secretes pus, is covered with pale-red granulations, which gradually rise into the aperture in the bone, unite with the granulations of the bone and of the external parts, and form a tough scar (1). During this proceeding we must endeavour to assist the union of the parts by bandaging, and by gradually passing to a nourishing and strengthening regimen. If, after trepanning, symptoms of pressure and irritation of the brain continue or first arise, it must be ascertained whether the cause be in the wound, in the presence of splinters, or in biliary impurities, for the removal of which a repetition of the operation, or the treatment already laid down, may be necessary.

Various are the opinions and notions which have been put forward upon the nature and way in which the opening in the skull is filled up after trepanning or other loss of bone. But the process which nature employs for closing holes in the skull is distinguished in no respect from the process of regeneration observed in other bones. The *dura mater*, *pericranium*, and bone all contribute thereto. A tissue in form of granulations is developed from each structure which fills up the aperture, and in which, as in the original formation of bone, bony granules are deposited, unite with each other, and thus either perfectly or partially make up for the loss of the bone. In the latter case, the growth of the bone is for the most part restricted to the circumference, and seems to project from the edge of the aperture and spread to a certain distance from it. Hereon is grounded Larrey and others' incorrect opinion, that the loss of substance in wounds of the skull depends on length of time and on the thinning of the opposed concentric bony fibres. As the *dura mater*, *pericranium*, and bony tissue, according to their secretive activity and plastic power, contribute to the restoration of the skull-bones; so is it also seen that according as the *dura mater* is entire, the *pericranium* not much destroyed, but especially that there is not any great loss of bone, the tissue filling the hole in the bone is, in proportion to the various degrees of plastic activity in young and old persons, either completely or partially converted into actual callus, which is often merely fixed like a pad about the edges of the bone, or has in it no bony growth. In the latter case the edges of the bone are covered with cartilage without a trace of actual bony deposit. In one case which was consequent to the penetration of a stake through the skull into the brain, I observed a cure, although distinct disturbance of the brain remained: the patient died long after.

Upon this subject refer to Scarpa, De Anatome et Pathologia Ossium Commentarii. Ticini, 1827. sm. fol.

Weissbrod, Ueber die Heilung der Trepanationswunden und der Knockenverletzungen überhaupt; in the Jahrbüchern des arztlichen Vereines in München, 1831. Part I.

van Dockum, D., Dissert. Anat. path. de Cranii regeneratione. Traj. ad Rhen., 1837.

Vrolick, G., Bemerkungen über die Weise, wie die Oeffnung in dem Schädel nach der Trepanation oder anderem Knocken verlust ausgefülltwerd. Amsterdam, 1837.

Dubreil, Ueber Regenerations thätigkeit der Kopfknochen; in Presse Médicale. 1837. No. 57.

450. If the pus be thin and bad, strengthening internal medicines must be given, and applications of the same kind put on the dressings. If any irritation keep up the suppuration, it must be removed; if any pieces of bone be loose they must be withdrawn. If the *dura mater* be tense and dirty; if a fungous growth rise from its upper surface, and prevent the escape of the discharge, it must be bound up with drying remedies, pressure applied, and careful touching with lunar caustic employed; and, if the fungus do not subside therewith, it must be taken away with the handle of a scalpel, or cut off with a knife. The brain may also grow up luxuriantly through the opening of the trepan, partly as consequent on expansion of the brain after the removal of the pressure, partly when, as consequence of external violence or of inflammatory congestion, the delicate vessels of the brain pour out blood into its substance, in consequence of which the brain stretches towards the aperture in the bone, and ulcerates the *dura mater*. The brain thrusts through the opening and grows in bulk as the effusion of blood adds to it; at last it tears through the *pia mater*, and the layer of brain surrounding the blood, which then pours out, coagulates and collects as the bleeding recurs.

The *treatment* consists in blood-letting, purging, and the application of moderated pressure; if the swelling continue increasing it must be emptied by introducing a lancet, or removed with a knife. If, with an increasing swelling, the aperture in the skull be too small for the escape of the blood, it must be enlarged with the trepan.

Flourens, Mémoire sur les Exuberances du Cerveau par l'Ouverture du Trépan. Paris, 1830.

451. As the scar of the trepan opening, in young subjects only gradually, in adults rarely, and in old persons never acquires the solidity of the other parts of the skull, it must, to maturity, or, in adults throughout the rest of their life, be covered with a plate of dressed leather (a less bulky one is made of metal lined with wool) to protect the brain from pressure and from external violence.

Larrey (*a*) has observed that after closure of the hole, the shape of the skull is changed, being flattened on the side of the injury; the mental activity is simultaneously diminished.

452. The various bandages recommended for injuries of the head may be ranged in three classes. I. *Many-tailed bandages*—1, the six-tailed; 2, the eight-tailed; 3, the four-tailed or Galen's sling: II. *Head-cloths and caps*—1, the four-cornered or great head-cloth; 2, the three-cornered, or little head-cloth; 3, Schreger's three-cornered head-bandage; 4, the night-cap; 5, Stark's net: III. *Rollers*—1, the single roller; 2, the scaphoid bandage; 3, the T-bandage, especially Schreger's movable one; 4, Dionis's frontal bandage; 5, Hippocrates's cap; 6, the knot bandage for compressing the temporal artery. Of all these bandages I employ Schreger's *movable T-bandage*, for all wounds, with flaps, and for fastening separate bandages, the *three-cornered head-cloth* as a general covering bandage, and Hippocrates's *cap* as the general compressing bandage; all the rest are superfluous.

(*a*) Velpeau, above cited, p. 265.

453. *Abscesses in the Liver*, and also in other intestines of the belly, not rarely occur after previous injuries of the head. They often happen without the intestines having suffered any shock ; and often they do not take place, although there has been a severe shock (1). They more frequently appear after injuries of the head, which suppurate, than after concussion without wound. They are frequently observed in affections of the brain which depend on internal causes ; for instance, in chronic inflammation of the membranes, in the so-called fungous growth of the *dura mater*, and so on.

[(1.) " In the liver," says HENNEN, " morbid appearances are found throughout every shade of affection of its membranes or its secretion; either pain and tumefaction with bilious diarrhœa, or the same with a perfect torpor of its functions, and inflammatory affections, from increased vascularity, to the formation of extensive collections of matter. In the spleen pain, tumefaction, hardness, and abscess are occasionally observed. The stomach suffers more frequently than any other organ; but it appears to be more from general nervous sympathy than from any organic affection, which is seldom discoverable on dissection." (p. 310.)

HENNEN further, and very justly remarks:—" It often happens, however, that neither the liver nor any other organ seems to sympathise with the injuries of the head, while, in other cases, almost every viscus will appear to suffer more or less. The sympathetic affections vary in the organs which they attack, and in the degree of violence. In the thorax they appear from simple increased secretion of the lungs, to tubercles and extensive purulent formation in their substance. Serum is also found in the cavity, and very frequently in the pericardium, and even in the heart itself abscesses have been discovered." (p. 310.)

The same writer mentions that " priapism is occasionally observed in wounds of the head," and mentions a case in which, " on dissection, the *dura mater* was found extensively separated all over the head. This separation included the *tentorium cerebelli*, and beneath its edge about four drachms of coagulated blood were found, the principal part of which lay on the *cerebellum*." (p. 304.)

As to the " loss of the generative faculty, and atrophy of the organs connected with it, which have been attributed to blows on the back of the head," HENNEN observes, " the fact is certain; but whether the anti-aphrodisiac effects proceed from injury to the organs of sexual love or to a general loss of power, is a subject for future inquiry." (p. 302.) On this point he quotes the two cases mentioned by LARREY, and that of a Portuguese soldier who was his own servant, and in whom " a piece of shell shattered the superior part of the occipital bone from within half-an-inch of the great knob on the left side to the lambdoidal suture. An irregular angular portion of the left parietal bone, nearly an inch in length and about an inch in breadth, was also fractured and beaten inwards." This man laboured under very dangerous symptoms, but had recovered five months after; but he " repeatedly consulted HENNEN on the means of recovering his virility, which, he said, the shell had completely carried away with it." (p. 303.)]

454. Abscesses of the Liver, after Injuries of the Head, are not always produced by one and the same cause. They are either the consequence of an indistinct but intimate *sympathetic change of relations* between the liver and brain, owing to which, when one organ is affected, slight disturbances occur in the others (1), or they are consequent on the shock of the whole body, connected with injury of the head, and by which the liver, on account of its bulk and its loose connexions, suffers more than all the other intestines, and is often torn so that fatal effusions of blood take place into the belly.

[(1) With regard to the sympathy between the brain and liver, HENNEN observes that " it is by no means such an universal occurrence as some practitioners imagine; nor does the affection of the liver, I suspect, so *very* often depend upon the direct injury of the head as upon certain circumstances connected with it. A class of men more peculiarly liable to hepatic affections than others, are the most frequent subjects of fractured skulls, I mean quarrelsome and habitual drunkards, particularly those who indulge in ardent spirits; and we often find that the liver has been diseased long before the infliction of the injury of the head. It is scarcely necessary to say, that it will very often occur in men of the most temperate habits, and totally unconnected with the affections of the organs from habitual drinking; I have known it take place within thirty-six hours from an accident in a temperate female." (p. 309.)]

455. These abscesses of the liver often form without being noticed; often are they preceded by symptoms of more or less active inflammation. The pus is frequently superficial, but most commonly deep in the substance of the liver, and the entire parenchyma of that structure is not unfrequently entirely destroyed by it. In such abscesses swelling and fluctuation may be observed in the region of the liver, and the abscess opens externally; it may also empty itself into the general cavity of the belly, into the stomach, into the intestine, or into the cavity of the chest.

456. It is therefore necessary to prevent such abscesses, which, however, on account of their concealed mode of origin is often impossible. In symptoms of inflammatory irritation of the liver, bleedings and long continued antiphlogistic purgings, especially antimonial wine properly diluted, are indicated. If the abscess show externally, it must be, as usual, opened. If the outflowing pus be good and of white colour, the prognosis is more favourable than if it be of a yellowish brown colour. The powers of the patient are to be supported by strengthening medicine, and a ready outlet must be furnished for the pus.

Upon the various opinions regarding abscesses of the liver after injury of the head, compare,

Paré, A., Œuvres Chirurgicales, livr. x. chap. xii.

Bertrandi, Mémoire sur les Abcès du Foie, qui se forment à l'occasion de Plaies de la Tête; in Mémoires de l'Acad. de Chirurg., vol. iii. p. 486.

Pouteau, Œuvres Posthumes, vol. ii. p. 129.

Desault, Œuvres Chirurgicales, vol. ii. p. 63.

Richeraud, sur les Abcès du Foie, qui accompagnent les Plaies de la Tête; in Journal de Médecine, etc., par Corvisart, Leroux et Boyer. Frimaire, an xiii.

Ansiaux, Clinique Chirurgicale, Liége, 1816, p. 35.

Textor, in Neuen Chiron., vol. i. part iii. p. 409.

Dance, Archives Générales de Médecine. Jan. 1829.

OF WOUNDS OF THE FACE.

457. A very important object in the treatment of wounds of the face is the prevention of scars; in all cases, therefore, if the wound gape widely, if it be irregular and large, if a strong beard or the peculiar position of the wound prevent the close lying of the sticking plaster, and no contra indications to quick union exist, the suture should be applied. Although wounds of the face usually bleed freely, yet the bleeding from the little vessels is safely stanched by the proper union of the edges.

[The twisted suture upon thin pins is the best remedy in all wounds about the face, excepting those of the eyelids, where, in consequence of their recession behind the bony margin of the orbit, they cannot be used. A cold wet rag is to be kept constantly applied, whichever suture is employed, and the suture itself must be removed after thirty or forty hours. Even if the wound be produced by a blunt instrument, it is advisable to attempt union with the suture. If the cut be at any part where there is hair, the edges of the wound must be so carefully adjusted that no hairs should jut into them, as thereby the union will be prevented, and irritation excited.—J. F. S.]

458. *Wounds of the region of the Eyebrow*, when they are especially disposed to union, if they be vertical, are always united with sticking plaster; but transverse wounds require the suture. If such wounds heal by suppu-

ration, their dressing consists only in covering them simply with masses of charpie, fastened with sticking plaster.

Wounds in the region of the eyebrows often cause blindness or weakness of sight: 1. *From concussion of the nervous coat (retina) of the eye.* Amaurosis appears in this case directly after the injury, and the iris is completely motionless. This amaurosis frequently subsides of itself, or by the use of purgatives. If the concussion produce tearing of the retina, extravasation takes place in the chamber of the eye, deep-seated pain, extraordinary sensibility of the eye on the slightest touch, complete blindness, in this case incurable, and especially indicating a strict antiphlogistic treatment for the prevention of inflammation. 2. *From bruising and imperfect tearing of the great branches of the frontal nerve.* Hence, also, follows diminution of the powers of sight, sometimes at once, sometimes later. The place and condition of the wound must lead the surgeon in his diagnosis. The frontal nerve must then be cut through on the upper eyelid, and the wound treated according to the general rules. 3. *From dragging of the frontal nerve, as consequent on the formation of a scar.* The diagnosis is clear, on account of the subsequent occurrence of weakness of sight. Cutting through the nerve is the only remedy. 4. *From complication of the above-mentioned causes.* The treatment of the wound here requires the first attention; subsequently the commotion of the retina is to be looked to. The same states of the eye may also be produced by wounds of the infraorbital region. I have seen a case of complete amaurosis occur suddenly eight days after a blow on the region of the eyebrow, though there was not any trace of it on the skin, in which the pupil was natural and movable, and there was not the slightest pain. By repeated bleedings, rubbings-in of mercurial ointment, and several blisters along the course of the frontal nerve, a perfect cure was effected.

[JOHN THOMSON mentions "a frequent and most distresing species of injury, which occasioned blindness by the passage of balls through or near to the eyes. In the cases where balls had passed near to the eyes, the vision was destroyed; in some without any apparent injury of the eyeball itself; and in others, with the occurrence of every degree of inflammation in that organ. In one case, where the ball had passed through behind the eyes, from temple to temple, one eye was destroyed by inflammation and the other affected by amaurosis. In another case where the ball had taken precisely the same direction, both eyes were affected with amaurosis, but without inflammation being produced. In another case where the bullet had entered the face on the upper and left side of the nose, and passed out anterior to the right ear, the patient was affected with amaurosis of the right eye. The left eye was similarly affected in a case where the ball had entered the right side of the nose, and had come out before the left ear. We had occasion to see from eight to ten patients, in whom musket-balls had passed through behind the eyes, from temple to temple; and in all of these there was great swelling, pain and tension of the head and face. A careless examination would have led one to suppose that in these cases the ball had entered the *cranium*. Cases of this kind are recorded in which the blindness is supposed to have been produced by the balls passing through the inferior part of the anterior lobes of the brain; but the results of my own observation would lead me to doubt whether, in those cases, the substance of the brain itself had been actually injured. In some of the patients in whom amaurosis had been produced, there was reason to believe, from the course which the balls had taken, that the optic nerves were divided. In a considerable proportion, however, of those affected with amaurosis, it was obvious that the balls had not come into contact with these nerves." (pp. 65, 6.)

FARDEAU (*a*) relates the case of a soldier wounded at the battle of Pultuska, in 1806, by a dismounted bayonet impelled by a ball, which struck him "on the right temple two finger's breadth beyond the angle of the orbit, and a little above it, passed up to the hilt, from before backwards, and from above downwards, so as to traverse the maxillary sinus on the opposite side, and projected five inches. The man was knocked down, but did not lose his senses. He made several ineffectual efforts to pull the bayonet out, and two comrades, one holding the head, whilst the other dragged at the weapon, also failed. The poor wounded man came to me leaning on the arms of two fellow-soldiers. I endeavoured with the assistance of a soldier to pull out the bayonet, but it seemed to me as if fixed in a wall. The soldier who helped me desired the patient to lie down on his side, and, putting his foot on the man's head, with both hands he dragged out the bayonet, which was immediately followed by considerable hæmorrhage, the blood pouring forth violently and abundantly. The patient then first felt ill, and, as I

(*a*) Observation sur une Plaie de tête par une bayonette lancée par une boulet; in Journal Gén. de Méd. de Chirurgie et de Pharm., vol. xxiv. p. 287. An 1809.

thought he would die, I left him to dress other wounded. After twenty minutes he revived, and said he was much better, and I then dressed him. We were in the snow, and as he was very cold the whole of his head was well wrapped up in charpie and bandages. He set off to Warsaw with another wounded soldier; went partly on foot, partly on horseback, or in a cart, from barn to barn, and often from wood to wood, and reached Warsaw in six days. Three months after I saw him in hospital, perfectly recovered. He had lost his sight on the right side; the eye and lid had, however, preserved their form and mobility, but the iris remained much dilated and immovable." He mentions another case in which "a ball passed through a soldier's head, from the top of the base of the right parietal bone, and which he extracted from the zygomatic pit on the other side. He was cured in four months, and walked about at the end of a month." He refers also to a case of DE LIMBOURG's, of which the following is an extract:—A young man was ramming down the powder in his fowling-piece with an iron ram-rod, the gun went off, and the ramrod struck the head of a person a few paces distant, and, entering a finger's breadth by the side, and as much above the outer corner of the eye, at the root of the zygomatic arch, passed through the teguments at the back of the head, at the posterior superior angle of the parietal bone, a finger's breadth from the sagittal suture, and as much above the superior angle of the occipital bone. The wounded man immediately endeavoured to pull the ramrod out, but ineffectually; but one of his companions at last pulled it out, as straight as when it left the maker's hands. He lost little blood and only at the apertures of the wound, which healed quickly and completely by simple but proper treatment.

In speaking of gun-shot wounds in the neighbourhood of, or penetrating the orbit, the following are some of the most important mentioned by HENNEN:—"Sometimes the ball passes behind the eyes, destroying their power, either by cutting the optic nerves at once, or causing their subsequent inflammation and thickening. An additional proof of the decussation of these nerves is afforded by the effects of gun-shot wounds of the eye; for, in many instances, an injury by a ball inflicted in the neighbourhood of one produces paralysis of the other." (p. 340.) "In some cases the ball passes into the orbit without bursting the eye-ball, although the power of vision is totally lost." (p. 341.) "Diplopia sometimes, though rarely, takes place from gun-shot wounds in the neighbourhood of the eyes, of which the following case is an example:—A. B. received a wound from a musket-ball, which brushed along the root of the nose and onwards towards the right eye-brow, but without producing any injury to the bone, and so little derangement that the wound healed in a very few days. Immediately on being struck by the ball, double vision took place. * * * In about two months the disease was removed, but, on running into some excess in drinking, it returned again, and the wound burst out afresh. A recurrence to a more rigid regimen perfected the cure in a fortnight, and he was discharged entirely from hospital." (p. 345.) Sometimes a ball will enter the orbit, and afterwards descend into "the posterior part of the *fauces*, forming a tumour behind, and nearly in contact with the *velum palati*," which happened to a soldier, who, in consequence, suffered severe pain, had his respiration impeded, his deglutition obstructed, his speech rendered indistinct, and much irritation in the *fauces*, attended with constant flow of saliva and frequent inclination to vomit." (pp. 341, 42.)]

PLATNER, Progr. de Vulneribus Superciliis ilatis, curcæcitatem inferant ad locum Hippocrates. Lipsiæ, 1741.

BEER, Lehre von den Augenkrankheiten, Wien, 1813, vol. i. p. 168.

VON WALTHER, in his Journal für Chirurgie und Augenheilkunde, vol. iii. p. 1.

CHELIUS, Handbuch der Augenheilkunde, vol. i.

459. *Slight longitudinal and transverse Wounds of the Eyelids* may be always united by court plaster, if it be only so placed that its ends are not loosened by the moisture of the tears. In vertical wounds, dividing the eyelid, the suture is always to be recommended, the threads, however, are to be drawn only through the external fold of the skin, and between the threads strips of court plaster are to be applied. The eye is to be kept closed with a vertical strip of plaster, and covered with a compress. Horizontal wounds of the eyelids, if large and connected with loss of substance, require the suture for their perfect closure, although, in many cases, they can be united by strips of sticking plaster stretched from the cheek to the

forehead, and the cheek is to be kept up by the bandage called *monoculus.* Small strips of plaster are to be laid between the threads, and the motions of the eyelid are to be prevented by vertical strips of plaster.

460. *Wounds of the Ear* are difficult to unite on account of the many elevations and depressions of the auricle; and it is for the most part necessary to put in, at several points, sutures, which should penetrate only the external skin. If the ear-passage be also injured, it must be stopped with charpie, by which the edges of the wound are brought together, and its secretion prevented collecting there (1). Charpie having been laid about the whole ear and in its cavities, it is to be covered with a compress, and the whole fastened with a cloth folded together, which being placed under the chin is carried up over the ears and bound together on the head. If the external ear be completely cut off, or attached only at a small part, its union must always be attempted.

[(1) If the gristly part of the ear-passage be cut or torn, on no account must CHELIUS's recommendation of stuffing it with charpie or lint be followed. It is not necessary, for the parts can easily be kept together by supporting the back of the auricle; and it is sure to be mischievous and painful, because it plugs up the hollow in which the inflammatory swelling has opportunity otherwise to take place. If there be much bruising, it is preferable to cover the whole ear with a bread poultice, and bring the edges of the wound together afterwards when they have begun to granulate.—J. F. S.]

461. *Wounds of the Nose* may split it either in the middle or on its wings, or a part of the nose may be almost or completely divided like a flap. Cuts which split the nose in the middle may be united with sticking plaster, and the union assisted with compresses and a double T-bandage, or by a piece of sticking plaster, cut out in shape of the letter U. If the wings of the nose be divided, they must be united with the suture, which should hold only the skin. Wounds which divide the length of the nose horizontally, or more or less obliquely, so that a piece is either entirely divided, or remains only slightly attached, must be united by the stitch and by sticking plaster. But when a small portion of the tip of the nose, in this direction, is lost, a piece of plaster put on obliquely may be useful. Elastic tubes are to be placed carefully in the nostrils, and properly fastened to the bandage.

The bandages for the nose, to wit, 1st, the simple bandage; 2nd, the single *accipiter;* 3rd, the double *accipiter;* 4th, the nose-sling; 5th, the upsilon-bandage; 6th, the T-bandage; 7th, the double T-bandage of SCHREGER, the operation of which consists either in lateral compression of the nostrils, in pressure upwards or downwards, are, as regards their application and operation, extremely uncertain, and may be rendered superfluous by the proper employment of sticking plaster (as the four-headed sticking plaster and plaster bandage of BÖTTCHER.)

462. *Wounds of the Cheek* may mostly be united by sticking plaster; but when they gape much, are angular, the lips completely divided, or the salivary duct injured, they require the suture. In all penetrating wounds of the cheeks and lips, when any vessels are to be tied, the ligatures are to be applied in the mouth, and to be led out from one or other of its corners. If, in injuries of the salivary ducts, the wound do not heal perfectly by quick union, and the spittle flow from the still open aperture, the healing of the duct must be always attempted, and the origin of salivary fistula prevented by repeatedly touching with lunar caustic, and by compression of the parotid duct with the halter bandage. Chewing and speaking are also to be forbidden.

463. *Wounds of the Tongue,* when superficial, heal if it be kept at rest; but deeper and especially transverse wounds require sutures. The patient

must neither speak nor chew; he must be fed with strong broth, which is to be conveyed into the stomach by an elastic pipe passed through the nose, or by nutritious clysters.

[Lawrence observes (*a*), when the tongue is severely bitten during fits, "that bleeding takes place which is very difficult to stop. I remember," says he, "having had a child under my care who had bitten very deeply into the substance of the tongue, just at the broadest portion of its loose under part; he had divided it horizontally, nearly in the middle line, and bleeding took place, which I found it impossible to restrain by any styptic application. I employed in vain the oil of turpentine, and a saturated solution of alum freely, and the child had lost so much blood, that I deemed it in danger, if hæmorrhage continued or recurred. But at last I stopped the bleeding by the following measure, which, however, seems rather a rough one: I introduced at the basis of the loose part of the tongue, bringing it downwards, a strong needle armed with a ligature, and cutting the ligature off after I had brought the needle through, made two ligatures; I tied them tightly one on each side, so as to embrace between the two the whole surface of the wound, including nearly half of the loose under part of the tongue. This stopped the hæmorrhage. I was rather apprehensive that, by causing the loss of so much of the substance of the tongue, some bad effect might have been afterwards produced, but it was not, and the subsequent articulation of the child was perfect." (p. 763.)]

OF WOUNDS OF THE NECK.

464. *Wounds of the Neck* either injure merely *the coverings*, *the superficial muscles*, or *the deeper-lying vessels and nerves*, *the wind-pipe and gullet*, or even *the spinal marrow*. Cuts are the most frequent and have either a vertical or transverse direction. If they penetrate merely through the skin and superficial muscles, they may be united with sticking plaster, and the union of transverse wounds on the front of the neck may be assisted by binding the neck forwards, but in longitudinal wounds it must be stretched backwards. Bleeding from the external jugular vein may be stanched, either of itself or by slight pressure. In wounds with loss of substance, or such as suppurate largely, the head, towards the end of the cure, must always be kept straight, and the sinking of the pus behind the breast-bone prevented.

[Astley Cooper says that the wound above the larynx, which passes through the muscles of the jaw and tongue, into the pharynx, being generally inflicted between the chin and *os hyoïdes*, is the most frequent injury. (p. 242.) The wound may be either above or below the tongue-bone, and in the latter case the *epiglottis* is commonly more or less completely sliced off, which renders the case more dangerous on account of the irritation to which the larynx is subjected. In one such case Astley Cooper stitched the epiglottis to the thyroid cartilage, and the patient recovered, but he was uncertain whether the recovery was attributable to that proceeding.]

465. Deeper penetrating wounds, in which the large vessels are wounded, are usually soon mortal from the sudden bleeding. In injury of the carotid artery assistance is still possible if it be at once compressed by an assistant at the wounded part, the wounded end laid bare and tied (*b*). In slight injury of the internal jugular vein, the bleeding should be stanched by compression, or, if it be completely cut through, it must be compressed above the injury, and the upper end tied after proper enlargement of the wound. In making these ligatures sufficient care should be taken that the nerves lying

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(*a*) Lectures in Lancet, 1829–30. vol. ii.

(*b*) Hebenstreit; in his additions to Benjamin Bell's Surgery.
Abernethy's Surgical Works, vol. ii. p. 115.
Larrey, Mémoires de Chirurgie Militaire, vol. i. p. 115.
Hennen, John, Observations, &c., p. 356.
Collier; in the Medico-Chirurgical Transactions, vol. vii. p. 107.
Cole; in London Med. Repository, May, 1820
Thomson, John, M.D., Report of Observations made in the British Military Hospitals in Belgium, &c., 1816. London. 8vo.
Breschet; in French edition of Hodgson's Treatise on the Diseases of Arteries and Veins, &c., 1815. London. vol. ii. sect. v. p. 37, *note*.
Textor; in Neuen Chiron., vol. ii. p. 2.

close to the vessel, especially the pneumo-gastric, be not included in the ligature. The injured branches of the carotid artery may be tied either in the open wound, or after carefully enlarging it, or, if this be not possible, the principal trunk of the carotid is to be tied (1).

[(1) The celebrated Marquis of Londonderry destroyed himself by stabbing the carotid artery with a penknife; and at the time it was believed that had his medical attendant acted promptly and properly, his life might have been saved. I recollect an instance many years since under my friend Travers's care in St. Thomas's Hospital, in which either the lingual or facial artery was also wounded with a penknife in an attempt at self-destruction. The wound was enlarged with the intention of tying the bleeding vessel, but the wound in it was too close to its origin to admit such proceeding. The common carotid artery was therefore tied; but the case was unsuccessful, as adhesion never took place, and when the ligature ulcerated through, bleeding occurred several times; at last a large clot formed in the wound, from which constant oozing went on; and on the removal of this to secure the artery, a violent gush of blood followed, and the patient died immediately.—J. F. S.]

466. *Injuries of the Pneumo-gastric Nerve* cause loss of voice, spasmodic symptoms, and death. Injury of the *Recurrent Nerve* also causes loss of voice; this, however, may occur subsequently. Injury of the *Laryngeal Nerve* is mortal from arrest of breathing (*a*); and this is also the especial branch which so quickly produces death after the division of the whole nerve. According to Dupuy's (*b*) experiments, animals may live for some time after division of both pneumo-gastric nerves, if the air-tube be opened below the larynx; but, if the opening be not made, the animal dies on account of the palsy of the nerves spreading over the muscles opening the chink of the glottis. If the *Sympathetic* or *Phrenic Nerve*, or the spinal marrow be injured, death in convulsions follows.

467. *Wounds of the Windpipe* are either longitudinal or transverse; the windpipe may be either only cut into, or cut through, or a piece of it taken away as in shot-wounds. Vertical wounds of the windpipe require union with sticking plaster, and that the head should be inclined much backwards. Transverse wounds divide it either partially or entirely; they are mostly consequent on attempted self-destruction, and are usually found at the upper part of the neck, between the larynx and the tongue-bone; penetrate to a great extent into the back of the mouth; allow the air, spittle, and drink to escape through them, or even penetrate into the larynx. They are rare at the lower part of the windpipe.

In these wounds, if the voice be at once lost, the air passes through the wound (1), frequently an air-swelling is produced (2), and blood flowing into the windpipe may give rise to dangerous symptoms. This may occur without the *carotid artery*, *jugular vein*, or *pneumo-gastric nerve* being wounded; the bleeding may come only from the *superior thyroid*, or from the *lingual artery*.

[(1) The loss of the voice in large wounds of the windpipe simply depends on the air passing out through the aperture, instead of proceeding through the larynx; this is readily proved, if by bringing the head forward, the edges of the wound can be brought sufficiently close to prevent the escape of the air through it, as then the air takes its natural course through the larynx, and a whisper more or less loud, or even a feeble voice can be heard.

(2) Hennen says:—"Emphysema is also a frequent though not dangerous symptom of wounds of the windpipe; indeed I have met with it oftener in wounds of the larynx and trachea than in those of the lungs, probably because the action of the muscles subservient to respiration is exerted in such a manner as to send a current of air through

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(*a*) Pye, Aufsätze und Beobactungen aus der gerichtlichen Arzneiwissenschaft. Saml. vii. p. 185.

(*b*) Journal de Médecine, par Le Roux, etc. vol. xxxvii. p. 351.—Meckel, Handbuch der gerichtlichen Medecin. Halle, 1821, p. 172.

the larynx, whence it is drawn forcibly into the cellular substance. Simple puncture is, in these cases, the best remedy." (p. 362.)]

468. When in transverse wounds of the windpipe the bleeding is stanched, the edges of the wound should be brought together by bending the head much forwards towards the chest, in which position it is to be retained. This is done less certainly by bandages than by KOHLER's cap; the patient is at the same time to be slightly inclined to one side, so that the secretion may not readily flow into the windpipe. If the windpipe be not completely divided, the edges of the wound should not be separated far apart, and the position already mentioned is favourable to union, as the stitches excite only irritation and cough which mostly hinder the union. Only when the windpipe is cut through, and the edges of the wound gape widely, should they be drawn together with a broad ligature fastening the external skin merely.

According to FRICKE (*a*), severe wounds of the neck should not at once be healed with the stitch; he prefers waiting for a perfect suppuration, and the production therewith of new granulations, and then first puts in the suture to bring the suppurating edges into contact.

[Position in the treatment of wounds of the windpipe, at whatever part, is always preferable to stitches, which are really of little service, as from the constant drag upon them in the frequent attempts made to get rid of the mucus, and of the adhesive matter which begins to be secreted a few hours after the injury, they speedily ulcerate and are of no use, but rather hurtful from their additional irritation. The only real benefit obtained from them is that of preventing the edges of the skin turning into the wound, which interferes with the union; but even in this attempt they often fail. Keeping the edges of the wound as near together as possible with strips of adhesive plaster, applied longitudinally and obliquely across the neck, and over these a roller twice or thrice around the neck is all that is either necessary or proper.

It must, however, be recollected that even at the very first it is not always proper to close the edges of the wound, and the Surgeon must therefore carefully notice, in dressing the wound, how the patient can breathe when the edges are brought together and covered up. Not unfrequently the breathing cannot be carried on by the mouth, but only by the wound; under which circumstances, if the wound be shut up, difficulty of breathing and even suffocation may ensue, unless all the dressings be removed and the air allowed to escape by the wound. Its complete closure, therefore, must be dependent upon the freedom or difficulty of breathing by the mouth; if there be no difficulty the wound may be carefully closed; but, if there be difficulty, a sufficient space must be left opposite the wound into the windpipe, to permit the free passage of the air.

Another circumstance may be also noticed as to the unneedfulness of stitches, that is, that these wounds rarely, if ever, unite by adhesion, but almost invariably by granulations, even under the most favourable circumstances. But the use of stitches after the establishment of the granulating process, as proposed by FRICKE, is quite superfluous.

It is certainly proper at first to attempt union by adhesion, and sometimes the angles of the external wound will effect it; but generally the parts have been so much handled in search of bleeding vessels, as well as irritated by their continual separation by the air and mucus forced through the wound, that the greater part of the surface becomes sloughy. When this happens, it is better to remove all the dressings, except two or three strips of plaster for support, and to surround the whole neck with a light bread poultice in a muslin bag, so as to prevent any of the crumbs dropping into the air-tube. —J. F. S.]

469. In these wounds there always occur severe inflammation of the windpipe, spasmodic symptoms, especially severe cough, which is more violent in injuries of the larynx than of the windpipe (1). If the wounded person have not lost much blood, he must be bled freely from a vein, and nitre in emulsion must be given internally. If pain and cough arise, bleeding from a vein (even the application of leeches) must be repeated,

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(*a*) Fünfter Bericht über die Verwaltung des allgemeinen Krankenhauses, 1832, p. 232.

and calomel with extract of hyoscyamus given. The food must be entirely fluid. Persons who have attempted self-destruction must be carefully watched, lest they disturb the bandages. This treatment must be persisted in so long as the inflammatory and convulsive state of the windpipe continues.

If union do not completely occur, the wound is to be covered with lappets dipped in lukewarm water. If the discharge be great, and the powers of the patient give way, Iceland moss, bark, and narcotic remedies must be used. The hoarseness which remains for the most part gradually subsides. In injuries of the cartilaginous part of the windpipe, there sometimes remains for a long while a fistulous opening, which often closes of itself (2). When the bandage is removed, the patient must guard against a deep inspiration, and much drawing the head backwards (3).

[(1) If there be much inflammation and cough it is always best to remove the dressings, even though the breathing by the mouth may be comparatively easy, and allow the mucus or other secretion to be coughed through the wound, as their discharge by that passage is more easily effected than through the chink of the glottis, and consequently the necessary exertion and irritation are lessened. If the case proceed favourably, after a week or ten days the secretion from the lining membrane of the air-tube diminishes, it becomes less viscid, and is separated with less exertion; the granulations begin to close the aperture, and breathing begins to be performed through the laryngeal chink, and daily increases till the wound has entirely healed. Astley Cooper mentions an instance of ossification and exfoliation of the thyroid cartilage, in a case where the cure occupied several weeks (p. 246); but I believe such occurrences are rare.

I have had a case of fistulous wound between the thyroid and cricoid cartilage, which had been of some weeks' standing before I saw it, and the passage through the latter into the windpipe had become so narrowed, either by the falling together of the cricoid cartilage, of which the front had been perhaps cut off from the hind part, or by the adhesions which had formed between the lining membrane, that breathing was performed with extreme difficulty, and with a loud hissing noise. As these symptoms had been gradually increasing it was thought advisable to introduce a short silver tube, to do which it was necessary to enlarge the aperture with the knife, and the tube having been passed in the breathing immediately became easy, and the hissing ceased. She wore the tube for several weeks without inconvenience, and left the house with it still in. In this case, as might be expected, the voice was entirely lost.—J. F. S.

(2) These cases are very uncommon. Astley Cooper says that in a wound upon the thyroid cartilage, which remained fistulous, he raised a piece of skin from the surface of the neck, above the opening, and turned it over it, having previously pared the edges, and it united extremely well." (p. 246.)

(3) Sometimes after a cut has been going on well for some days, a sudden bleeding may come on, either during the exertion of coughing or any other effort, and it will be extremely difficult, if not impossible, to ascertain whether the blood come from an artery or vein. A case of this kind recently occurred in our hospital under my colleague Mackmurdo's care. A man cut his throat nearly from ear to ear, on the night of the 7th of July, 1845: he lost a large quantity of blood, but when he was found the bleeding had ceased. On examining the wound it appeared that he had cut between the hyoid bone and thyroid cartilage, separating with the former the *epiglottis*. The edges of the wound were brought together by bending the head down to the chest, and cold water dressing applied. On the next morning one suture was put through the lips of the wound, and on the day following other two. On the fourth day they were all removed, as there did not appear any disposition in the wound to union. On the afternoon of the 14th the sutures were again introduced. At 5, A.M., of the 15th, he had a violent fit of coughing, and, whilst trying to reach the chamber-pot from beneath his bed, a sudden bleeding came on, said to be in a twisting stream. It was checked by pressure, but on the removal of the finger bleeding recurred, and he lost about half-a-pint of blood; but it was controlled by thrusting a piece of sponge into the bottom of the wound, which was left open, and cold water applied. No further bleeding having occurred, the sponge was removed on the 18th, and the wound has now (26th) filled with granulations, and the case has every appearance of doing well.—J. F. S.]

470. *In Stabs of the Windpipe,* owing to the parallelism of its inner and

outer walls, the air readily escapes into the cellular tissue. If slight pressure upon the wound do not prevent the escape of the air, the outer wall must be enlarged with the bistoury, so that the air may more readily escape.

471. *Bruised Wounds of the Larynx and Windpipe*, *Shot-wounds* with loss of substance, require besides the general treatment already mentioned, a simple linen bandage spread over with a mild ointment.

If the edges of the wound skin over, and fistulous passage form, which, especially occurs in bruises and in wounds connected with the loss of substance, the edges must be refreshed, (re-pared with the knife,) and, if possible, united vertically with the twisted suture. Attempts have been made to close the opening by healing over it a flap of skin (*a*).

472. *Wounds of the Gullet* occur with an entirely, or, for the most part, divided windpipe, (in stabs only is injury of the former possible without that of the latter,) and the gullet is either cut into or cut through. Severe wounds of the gullet are usually accompanied with wounds of the larger vessels and nerves, and are then speedily mortal. Without this simultaneous injury, however, wounds of the gullet may be very large; it may even be entirely divided without the wound being absolutely fatal (*b*). Injuries of the gullet in large wounds can be ascertained by the eye, by examination with the finger, and also by the fluid swallowed by the wounded person, escaping through the wound, and exciting severe cough.

473. When in wounds of the gullet the blood has been stanched, the same *treatment* is to be pursued as in wounds of the windpipe: the external coverings must be fixed, and the head bent towards the chest. If the wound be large, the patient must be supported with nourishing clysters, baths, or what is best by strong broths introduced by an elastic tube into the stomach. If the tube excite vomiting, coughing, or bleeding, it must be removed, and nourishing clysters and baths only used. The tormenting thirst of such patients is best relieved by putting into the mouth slices of lemon or Seville orange sprinkled with sugar. As the wound advances towards healing pappy gelatinous food must be cautiously given by the mouth.

The elastic tube kept in the gullet should be about as thick as the little finger, and provided with a valve at its top. It is introduced through the nose or mouth; it generally slips the first time into the windpipe, which must be ascertained by the motion of a taper flame held before the opening of the tube. In this case, the tube is to be drawn back, and attempt made to pass it more backwards into the gullet. It may remain many days, its outer end being fastened.

[(1) ASTLEY COOPER "objects entirely to the introduction of tubes into the *pharynx* and *œsophagus*, as worse than unnecessary, for they are highly injurious by the cough which they occasion by their irritating the wound; and, if adhesion or granulation have taken place to close the wound, such tubes tear it open again and destroy the process of restoration." (p. 249.) The correctness of this opinion is fully borne out by the following case related by STARK (*c*):—

CASE.—A man cut his throat; "the external jugular veins on both sides were perfectly divided; the carotid arteries laid bare; the *trachea arteria* divided from the *larynx* immediately above the *pomum Adami*; the *epiglottis* and *glottis*, along with the *os hyoïdes*, perfectly detached from the *rima glottidis;* the *pharynx* cut through, except about a finger's breadth of the back part, which was very much stretched, for the *trachea* thus divided had retracted equal to the clavicles, as had also the fore part of the *œsophagus*, which very much stretched the remaining fibres of the *pharynx*. As the *os hyoïdes* was perfectly detached from the *rima*, consequently every muscle that arises from the

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(*a*) La Lancette Française, 1831, 26 Nov.—FRORIEP's Notizen, 1831. No. 692.

(*b*) RUST, Einige Beobactungen über die Wunden der Luft und Speise röhre, mit Bemerkungen in Bezug auf ihre Behandlung und ihr Lethalitätsverhältness, in his Magazin, vol. vii. p. 262.

(*c*) Medical and Philosophical Commentaries, by a Society in Edinburgh, vol. iv. part i. London, 1776.

different cartilages, &c. of the windpipe, and which are inserted in the *os hyoïdes,* were cut through. * * * I endeavoured to attach the fore part of the *œsophagus* to the *pharynx* with needles and waxed thread; but it was found very difficult to accomplish, as the wound was very jagged, the patient averse to have any thing done for him, and the pricking of the needles brought on violent retching to vomit, so that the contents of the stomach were evacuated by the wound. I next endeavoured to attach the *trachea* to the *larynx,* which was likewise difficult, on account of the constant convulsive coughing; however, it was at last done, and the patient in this situation could swallow a little water, though the greatest part still ran out by the wound." Some adhesive straps were afterwards applied. His bowels were kept open with clysters. No nourishment given by the mouth, but nutritive clysters thrown up every two hours. He went on very well till the sixth day, when he became very feverish; the discharge ichorous and offensive; the breathing quick and difficult, with a loud rattling noise. Hot dressings were applied to the wound. On the ninth day the fever had subsided, and the discharge from the wound thick and hardly in any degree offensive. On the following day, when the dressings were removed, "all the stitches had given way, and the windpipe and gullet had retracted as before. * * * Between the *os hyoïdes* and the clavicles there was only one continued gash, which looked as if the windpipe and the gullet had been cut out entirely." As he was now very much reduced, and both very thirsty and hungry, attempts were made "to introduce nourishment by the external wound, by means of a bent catheter that had a bladder tied to it; but the catheter had no sooner touched the top of the gullet than it produced violent efforts to vomit, and convulsive coughing, which tore the wound quite open. Finding this method would not succeed, I laid it aside, and trusted to strong nutritive injections only. I again put in a stitch or two into the fore part of the windpipe, but soon found they could be of no service, for they not only prevented a reunion, but kept up a constant irritation on these sensible parts. I therefore next day removed them, and only continued the stitches in the external wound, for the mucus and matter now prevented adhesive plaster from sticking; and in order that there might be very little stress on the external stitches, I kept his chin confined close to his breast by means of pillows under his head, and a night-cap with straps that tied under the arm pits. About this period small granulations of flesh made their appearance on the wound." On the twenty-fourth day he was "sitting up in bed with a plate before him containing boiled rice. I asked if he had swallowed any, to which he made signs that he had, by patting his belly, and expressing great joy of countenance. I desired he would make another attempt, and found, to my great astonishment, that he could swallow some, though by much the greatest part came out by the wound." He continued to mend, and "about the end of six weeks from the accident, the external wound healed up entirely, except over the *pomum Adami,* which, by being a little hurt, gradually separated; and as the separation was very slow, a small part of the external wound turned fistulous, and so left a passage into the windpipe, through which he could breathe at pleasure, though he generally breathed by the mouth as before, and could swallow either liquids or solids without any part coming by the wound." A fortnight after, he went out, got drunk, and vomiting the following morning, "some of the remains of the liquor probably got into his windpipe, for he fell back on his bed and expired in an instant." On examination, there was found "a perfect reunion of all the injured parts; the *os hyoïdes* was rejoined to the windpipe in the fore part by means of a soft but tough substance, which occupied the place of the scutiform and thyroid cartilage. The *rima glottidis* was attached to the sides of the *os hyoïdes* by a tough membranous cicatrix, which marked the extent of the wound in its first state. All the muscles inserted into the *os hyoïdes* and originating from the cartilages, &c., had, after being cut through in the accident, retracted, and on one side formed a large and hard substance, about twice the size of the *pomum Adami.*" (p 434–443.)

Dr. Ryan also relates (*a*) another, and very similar, case, in which, as in the former nature seems to have had most to do with the cure.

Case.—A negro received several wounds in the neck, which, when seen some time after the accident, appeared to be "thrusts or incisions with a knife between the upper edge of the right side of the thyroid cartilage and the *os hyoïdes;* one incision was made transversely, it began below and opposite the middle of the base of the *os hyoïdes,* and extended almost as far as the right carotid; it seems to have totally divided the sterno-hyoid and hyo-thyroid muscles. This incision was crossed by another, which was made in a longitudinal direction." When first found, "they gave him some drink, but it all came out through the wound; and they, as well as he himself, declared, that till the thirteenth day after the attack he swallowed nothing whatsoever. Hence he was almost

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(*a*) Duncan's Medical Commentaries, vol. viii. London, 1783.

exhausted, and his situation thought so desperate that recourse was had to none of the means usually employed in such circumstances in order to support life. From the time he began to swallow he has gradually recovered some strength, and he can now eat plantains, the chief fare of the negroes." When **Ryan** had removed the dressings, "on his attempting to drink some water, the most part rushed out by the orifice; but when it was closely stopped up by the application of another's hand, he swallowed pretty freely, though not without some coughing. It is always necessary to make a pressure of this kind when he takes any food. I had his mouth and nostrils closed for some time, but he breathed through the wound." (p. 319–21.)

Hennen has mentioned a case in which "the larynx was completely severed between the thyroid and cricoid cartilages, and the *œsophagus* laid open throughout half its calibre. * * * I confess we were at a loss what to do; for when we attempted to close the wound he could not breathe at all. We therefore left it open, keeping his head reclining forward, and expecting that he would soon be suffocated. This did not happen, however, for he breathed very well through the wound; but his greatest suffering proceeded from thirst, as every thing he attempted to swallow came through the opening. We tried to introduce liquids through a flexible tube, but we succeeded very badly, on account of the great irritability of the *fauces, trachea,* and *œsophagus.* As there was great abundance of milk to be had, he was put in a bath of this fluid several times a day, and clysters of various nutritious fluids were assiduously thrown up. By these means he was entirely supported during the space of eighteen days, and nothing but common dressings applied to the wound. At the end of this period, the *œsophagus* became retentive when liquids were taken, and the breathing was beginning to be partly carried on through the mouth. From this time he rapidly recovered, excepting a considerable loss of voice and power of articulation." (p. 364.)]

474. As wounds of the gullet very rarely heal by perfect agglutination of their edges, but the interspace is filled by the neighbouring parts, there usually remains some contraction at this part, or it bulges like a bottle, in either of which cases swallowing is difficult.

475. *Stabs of the Gullet,* if there be no accompanying severe injury, often heal without any symptoms. If the gullet be wounded at the lower part, the food that is swallowed may pass into the cavity of the chest.

476. Deep wounds at the back of the neck often produce a palsied condition, and also frequently a wasting, of the lower limbs. Wasting of the testicle and loss of the generative power have also been observed in these cases.

[Of the severe nervous symptoms occasionally following gun-shot wounds of the throat. **Hennen** mentions an instance in an officer who received a ball in "the sternal portion of the *m. sterno-cleido-mastoideus,* about an inch above its origin, which passed inwards towards the *thorax,* but no trace of its route could be discovered. On receiving the shot, he instantly dropped, not, however, perfectly senseless, but very much stunned. He felt as if he had received *three* distinct wounds, the most severe of which he referred to the arm of the wounded side, the two others, of nearly similar severity, to his throat and stomach." He lost "an enormous quantity of blood, which also gushed copiously from the wound at every effort to cough or vomit. * * * His left arm hung nearly lifeless, with a pulse scarcely perceptible; that of the sound arm was excessively quick, 120 in a minute, and very feeble. On the following day he was better, but had such an oppression along the course of the diaphragm, that he urged **Hennen** to cut for the ball, as he was certain, he said, it was the source of this pain. * * * He spat up a florid frothy blood very copiously, and the same issued occasionally from the wound. The efforts to vomit, and spasmodic catchings of the throat with globus and hiccup were very severe. On the third day the dyspnœa was almost suffocating, and the nervous symptoms ran very high. On the fourth day his voice was entirely lost, till the sixth, when it began gradually to return. On the thirtieth day, after severe spasmodic bilious vomiting, the speech was again affected suddenly. His arm, which had, after the first twenty-four hours, given him occasional uneasiness, and in which he felt a prickling sensation on the inner side, was particularly painful at the period of this spasmodic attack. It had been wrapped in flannel, and gentle friction had been employed to it; but upon examining it more particularly, it was found somewhat shrunk, and the fingers cold and nearly insensible to pressure. In about six weeks he went home to England, and continued improving." (p. 358–61.)

A case is related by **Kennedy** (*a*) of a man wounded on the right side of the thyroid cartilage by bullet, which, passing behind the *m. sterno mastoideus*, was next day found lodging a little above the superior costa of the scapula, and when cut upon two bullets joined by a neck were removed. The wound healed kindly in five weeks. "Immediately upon the patient receiving the shot, his right arm, from a little below the neck to the finger-points, became pale, quite cold and benumbed." Aromatic and spirituous fomentations were used, and the arm covered with bags. "In about twelve hours after the arm recovered some heat; but the thumb of that hand was seized with violent pain, which kept him all night from sleep; and the next day the pain was so unsupportable, that he was in danger of turning delirious, though his pulse was scarce quickened and he had no thirst or other sign of fever." Blood was taken from the arm again, (he having been bled also on the day previous,) clysters thrown up, and anodyne fomentations and poultices employed without relief. Some laudanum was given, which relieved the pain, but did not cause sleep, and the pain recurred next morning. The quantity of laudanum was therefore increased, and on the third night he had sleep; and afterwards it was given also in the morning, but in smaller quantity. As the effect of the opium diminished its quantity increased, till in the course of six or seven months the opium amounted to 250 drops of laudanum. Two months after he had received the wound, not only his thumb was pained, but such another pain was felt, at the joint of the elbow, without either swelling or hardness in the pained parts, or in the parts between them, and the fore-arm remained free from pain." At the end of seven months the pain began to abate, "but as the pain became less uneasy the feebleness of the member increased; and in twelve months the pain was gone, and the use of the arm entirely lost. About two years and a half after receiving this wound he went to Bath and used the waters for a season: when I saw him after that time at London, he told me he had recovered the full use and strength of his arm." (p. 167–70.)

IV.—OF WOUNDS OF THE CHEST.

Vering, über die eindringenden Brustwunden. Wien, 1801. 4to.

Herold, über die Behandlung trefer Wunden der Brust. Kopenhagen, 1801. 8vo.

Larrey, Mémoires de Chirurgie Militaire, vol. ii. p. 150; and in the Mémoires de l'Académie Royale de Médecine. Paris, 1828. Vol. I.

Rumebe, E., Dissertation sur les Plaies d'Armes à feu pénétrantes dans la Poitrine. Paris, 1814. 4to.

Hennen's Principles of Military Surgery. 2d Edit.

Mayer, C., Tractatus de Vulneribus Pectoris penetrantibus imprimis cum Hæmorrhagia conjunctis. Heidleb., 1823. 4to. Heidelberger klinische Annalen, vol. i. part iii. p. 365.

Reybard, J. H., Mémoires sur le Traitement des Anus artificiels, des Plaies des Intestins, et des Plaies pénétrantes de Poitrine. Paris, 1827. 8vo.

477. *Wounds of the Chest* (*Vulnera Thoracis*) are either *superficial* or may penetrate into the *cavities of the chest.*

478. *Superficial Cut and Sabre Wounds* require the same general *treatment*, and their union can always be produced by sticking plaster. *Superficial Stabs* (of which we satisfy ourselves by their direction, by the depth to which the injuring instrument has penetrated, and by examination with the probe, after placing the patient in the same position he was at the moment of the injury, and by the absence of the symptoms to be described in penetrating wounds of the chest) are also to be treated, according to the general rules, although the more active inflammation, which usually occurs in these wounds, requires a stricter antiphlogistic treatment. But when extravasation of blood takes place in the cellular tissue, and compression is not sufficient to stanch the bleeding, or when in

(*a*) Medical Essays and Observations, published by a Society in Edinburgh, vol. i. Edinburgh, 1752. 12mo.

the after-course of the wound a collection of pus takes place, and difficulty of breathing and so on occurs, the wound must be enlarged, the bleeding stanched, or a proper opening made for the escape of the pus.

Bruises and *shot-wounds* of the coverings of the chest may produce large outpourings of blood in the external parts, inflammation of the pleura and lungs, difficult breathing, spitting of blood, and so on, and require a strict antiphlogistic treatment, repeated bleedings, and cold applications to the chest.

479. *Penetrating Wounds of the Chest* (*Vulnera Thoracis penetrantia*) either simply open the *cavity of the pleura*, or at the same time wound the *viscera* lying within the chest. Their danger depends generally *on the bleeding* which comes out of the walls of the chest, or from the *viscera* contained in its cavities, from *compression* of the lungs and heart by the collected fluids, from *inflammation* of the *viscera* of the chest, and *their passages*.

480. We ascertain that a wound of the breast actually penetrates *into the cavity of the chest*, or even injures the *viscera* contained therein, by the depth and direction to which the injuring instrument penetrates; by the *careful* examination of the wound with the finger or with the probe, the patient being put in the same position as at the injury; by the influx and efflux of the air through the wound in inspiration and expiration; by an air-swelling (*emphysema*) which forms around the wound; by difficult respiration, in consequence of the air which enters the cavity of the chest compressing the lung and preventing the flow of the blood. In simultaneous injury of the lungs the patient suffers deeply fixed pain; breathing, especially inspiration, is very difficult; a frothy, pale-red blood pours in an unbroken stream out of the wound (1); the patient spits blood (the absence of spitting of blood is, however, no proof of the lungs being uninjured); sometimes also there are symptoms of internal bleeding and compression of the lungs, which are hereafter to be considered. The distinction of these wounds is more or less difficult according to their various size and direction (2).

Examination with the probe is, in most cases, illusive and uncertain; it may be very injurious, from the irritation connected with it, and is, in most cases useless, because the diagnosis is determined by other symptoms; and in a simple penetrating wound scarcely any other treatment is employed than in a wound that does not penetrate. The examination by injection, as advised by many, is still more unsatisfactory, and always dangerous.

The air passes freely in and out only when the wound is direct. The lungs do not always collapse, or fall together, when the cavity of the chest is opened, but remain in contact with the *pleura costalis*, which, in some cases, may depend on adhesion between the lungs and the *pleura*, but in others, is not to be explained. The opening, therefore, of both cavities of the chest is not directly mortal. WILLIAMS concludes from his experiments, 1st, that a lobe of the lung when exposed to the air does not collapse, so long as the functions of the other lobe and of the assistant organs continue undisturbed in respiration; 2nd, that one lobe of the lung possesses a peculiar power of moving for some time, entirely independent of the diaphragm and intercostal muscles, when, indeed, the other lung respires: the origin of this power WILLIAMS cannot determine; 3rd, that a sound lung recovers its natural expansive power when the pressure of the external air is removed; 4th, that although the external air passes freely and uninterruptedly at the same time through tubes of the same size into the cavities of the chest, the lungs, however, do not collapse, if the assistant respiratory organs have their activity still unrestrained; 5th, that a healthy lung never completely fills the cavity of the chest, at least in natural respiration. In my experiments on dogs, I always found great collapse of the lungs, and the motions which I noticed in them seemed to me less dependent on a distinct expansive power in the lungs themselves, than much rather on elevation and depression of the collapsed lungs in the laborious inspiration and expiration of animals, as will be described in accidents of the lungs.

[(1) To these symptoms ASTLEY COOPER adds "considerable irritation and tickling in the larynx." (p. 230.)

(2) In endeavouring to determine the course which balls take when wounding the chest, HENNEN's observation must not be forgotten, that "a ball striking the body or a limb will run round under the skin, and appear to penetrate right across the member or the cavity. By the deep-seated course which balls sometimes take, the deception is rendered still greater. Thus I have traced a ball by dissection, passing into the cavity of the thorax, making the circuit of the lungs, penetrating nearly opposite the point of entrance, and giving the appearance of the man having been shot fairly across, while bloody sputa seemed to prove the fact, and in reality rendered the same measures, to a certain extent, as necessary as if the case had been literally as suspected. The bloody sputa, however, were only secondary, and neither so active nor alarming as those which pour at once from the lungs when wounded. There is also another source of deception as to the actual penetration of balls into the cavities or the limbs; this is where they strike against a handkerchief, linen cloth, &c., and are drawn out unperceived in their folds." (p. 368.)

In the museum of the Royal College of Surgeons, London, there is a preparation of a most remarkable penetrating wound of the chest which recovered, and which was under the care of MAIDEN of Stratford, Essex (a), and the late Sir WILLIAM BLIZARD. In this case the lungs were probably not wounded.

CASE 1.—T. T., aged thirty-five years, on the evening of 13th June, 1812, having incautiously taken off the bridle, before disengaging his horse from the harness and chaise, the animal became unruly, and T. T., catching hold of the foretop, attempted to replace the bridle; "whilst thus occupied the horse made a violent plunge, and thrust him by the end of the off-shaft against the projecting part of the chaise-house; at which instant he felt the shaft perforate his side, under the left arm; whereupon he made a violent effort to draw himself back, while the horse kept plunging forward, and he soon felt the end of the shaft pass from under his right arm, occasioning acute pain. * * * The horse continuing to press forward occasioned on the left side a second wound, by the front tug-hook under the shaft." A person alarmed by his cries came to him, and drawing back the shaft discovered that its "end, which had confined T. T., had also entered the weather-boarding of the chaise-house, and passed through it, * * * and that he was pierced through the body by the shaft of the chaise, and apparently standing on tiptoe with both arms extended;" and that "the end projected several inches beyond the trunk of the body." The shaft was then gently withdrawn, and when released he respired two or three times, and found no alteration in his breathing; after which he walked up two flights of stairs to bed. Whilst being undressed for the first time felt faint, and soon had extreme difficulty of breathing, feeling as he said, "as if he should be suffocated by the blood trickling on his lungs." He was very speedily bled by a large orifice to the amount of four pounds, when fainting came on, but no stimulants were used, and only a little cold water given. Upon the left side of the chest there were two wounds, the lower by the iron under the shaft, and the upper where the shaft itself entered, immediately under the arm. On the right side was also a wound in nearly the same direction, through which the shaft came out; the latter two wounds, each four inches in extent. The left shoulder and side of the chest were slightly emphysematous. He had not thrown up any blood. On the morning of the 15th, as the difficulty of breathing had much increased, with considerable pain, weight, and soreness, he was bled to thirty ounces with much relief: and in the evening, as there was fulness of the belly and nausea, a castor-oil injection and five grains of calomel were given. On the following day vomiting had come on, and also pain about the region of the diaphragm, in addition to the previous symptoms; he was therefore bled to eighteen ounces. The vomiting increased, and was accompanied with hiccough, but towards evening these were relieved by effervescing mixture. On the 17th the difficulty of breathing being worse, seventeen ounces of blood were taken away, which alleviated the symptoms; and the bowels had been cleared by the calomel, which has been taken nightly. He had no pain in his back, nor any on either side except smarting at the wounds; but he thought from the great pain and tenderness about the breast-bone that it was broken. Next day the breathing being very laborious, he was bled to twenty-two ounces; but, though his respiration was relieved, he had still general tenderness in the chest and epigastric region, and therefore a large blister was applied over the front of the chest, which benefited him. On the evening of the 20th the breathing had become more difficult, and nineteen ounces of blood were withdrawn. Some threads of flannel were observed deep in the wound under the right arm, but were not disturbed. On the 22nd he had less pain and difficulty in breathing than since the accident, but complained of distressing sensations about the chest, which he could not describe. To-day his body linen was for the first time changed, and careful examination being made, not the smallest trace of injury could be found on the back. This done, it was thought advisable to take away fourteen ounces of blood, which relieved him more than before, not feeling any pain, only a smarting sensation, similar to that he had experienced in the wounds under the arms, on each side of the breast-bone internally, in the direction in which he was convinced that the shaft had passed. A blister was then re-applied, and kept open for some days. From this time he slowly recovered, and at the end of nine weeks the wounds were nearly closed. He lived for five years without inconvenience, except being put out of breath, on making any exertion, sooner than usual, and having the motions of his arms backwards, or raising them upwards, restricted by a feeling of tightness across the chest. After this time he occasionally suffered from considerable difficulty of breathing, irregular pulse, and struggling rather than pulsating action of the heart. He did not take much care of himself, and, after a time, became more seriously ill, and died *March* 2, 1823, nearly ten years subsequent to the accident.

(a) An Account of a case of Recovery after the shaft of a chaise had been forced through the thorax. London, 1824. 4to.

Examination.—The thorax was somewhat distorted, from an angular projection at the union of the upper and middle portions of the *sternum*, on each side of which was an irregular depression; on the left, and four inches and a half from the middle of the bone, the depression extended forwards three inches, along the intercostal space between the second and third ribs; on the right, at three inches distance, the depression extended backwards two inches between the same ribs. The upper cicatrix, on the left side, was behind the margin of the great pectoral muscle, and the under one an inch below it. The right cicatrix was opposite the intercostal space of the third and fourth ribs. The *m. pectoralis minor* adhered to a membranous substance occupying the place of the destroyed intercostal muscles, thin, smooth, strong, and transparent, through which the lung could be seen on the left side, but not on the right. The cartilage of the left second rib had been broken, and was only united by ligamentous substance, and the rib itself also fractured, two inches behind, had united with its inner edge turned a little into the chest; the third and fourth cartilages had been fractured, but united by bone. The right third rib had been broken. On opening the chest, the lungs were found strongly adherent, at their back part, to the *pleuræ*. In front, on the left side, the lung adhered to the displaced second rib, and to the membrane between the second and third ribs, the adhesions extending to the *mediastinum* as low as the fifth rib. Another portion of lung also adhered between the third and fourth ribs, where probably the tug-iron had entered. On the right side, the lung adhered to the membrane between the ribs, to the extent of an inch and a half around its margin. The *pericardium* was almost entirely adherent to the heart, but not very firmly. The heart itself was larger than usual, and the cavity and fibres on the right side proportionally greater than on the left.

MAIDEN observes, in regard to this case, and which the examination seems to bear out fully:—"I have no hesitation in declaring my firm belief that the shaft, being small at the top and of a wedge-like form, was forced between the ribs, on the left side, into and through the cavity of the thorax, under (behind) the sternum, and out between the ribs on the right side; not suddenly, but by several distinct movements, whence the lungs, large blood-vessels, &c., escaped injury." (p. 32.)

For the following case I am indebted to my friend ANDREWS, of the London Hospital, under whose care the man was. In this there can be no doubt that the left lung was penetrated.

CASE 2.—J. T., aged nineteen years, a Prussian sailor, whilst engaged in lowering, the trysail-mast (*a*), the rope supporting it gave way, and he was transfixed by its bolt, to the deck. At the time of the accident the mast had been lowered to within about six feet of the deck; the man raised his arms to lay hold of and guide the bolt into its proper place, when at the moment the suspending rope slipped or broke, and the mast dropping perpendicularly, fell on his chest, knocked him down on his back, and the bolt passing through his chest, pinned him to the deck, which it penetrated to the depth of an inch, so that his chest must have been compressed, from before backwards, to a space not exceeding four inches. Some time elapsed before the bolt could be drawn out, and he was then carried to the hospital,—

(*a*) The trysail-mast, about thirty-five feet long, and two feet in circumference at the bottom, has at this part an iron bolt five and a half inches long, and two and a-half wide, by which it fits into the boom, with a collar above to prevent it entering further.

Feb. 25, 1831, On his admission, 10, A.M., the countenance was livid, the breathing excessively distressed; small quantities of frothy blood were occasionally spat up, the pulse intermitting; and for some time after his admission, these symptoms increased, threatening almost immediate suffocation. The bolt had entered the chest, between the fourth and fifth ribs of the left side, about an inch and a half from the middle of the breast-bone, passed obliquely downwards and outwards, and came out between the eleventh and twelfth ribs, four inches from the left side of the spine, but was prevented passing further by the collar, which chipped out a piece of cartilage, leaving the point of the heart with very insecure protection. The fourth rib was broken at its junction with its cartilage, as was also the twelfth, and that side of the chest was flattened. In addition to his hurt, the scalp on the right side was considerably lacerated, extending from the frontal to the lower part of the occipital bone, and exposing a great part of the temporal muscle. The lower jaw was also badly fractured.

A pledget of lint was applied over the wound, and fastened with adhesive straps, but nothing more was done, and two hours after his admission the more urgent symptoms of suffocation had subsided, and he rallied a little.

7 P.M. The pulse had become full and rapid, varying between 100 and 110; the respiration on the left side was inaudible, except at the upper part of the chest; and on the right side it was puerile; twelve ounces of blood were taken from the arm, which slightly relieved him, and a dose of calomel and rhubarb given, which freely purged him.

Feb. 26. Has passed a restless night; pulse 110; tongue brown and dry in the middle. In the afternoon thirty leeches were applied to the chest: two grains of calomel ordered every four hours; milk at his pleasure. In the evening the same number of leeches were again applied; and, the pulse continuing accelerated, towards midnight ten ounces of blood were taken from the arm, which produced syncope, and on his revival the patient thought himself better.

Feb. 27. Had passed a quiet but sleepless night; pulse 110. Leeches were applied morning and evening.

Feb. 28. He passed a tolerable night, occasionally getting half an hour's sleep. The pulse continued rapid but weak. On applying the ear to the chest the pulsations of the heart were found violent, much more than indicated by the pulse. Thirty leeches were therefore ordered to the region of the heart. In the afternoon his bowels were copiously relieved. As towards evening he became restless, and dreaded a long night, fifty minims of laudanum were given at bed-time, which threw him into a profound sleep that lasted four hours.

March 1. Was not so well this morning; and the pulse being quick and fuller, the leeches were repeated on the chest, and fifteen ounces of blood, which was highly buffed and cupped, were taken from the arm; these rendered him faint, but somewhat relieved him. At midnight, the pulse continuing rapid, twelve ounces of blood were taken away, and a draught containing forty minims of laudanum and thirty of tincture of digitalis were given.

March 2. Has passed a good night, and had some refreshing sleep; pulse less frequent; tongue white, but the mouth not affected by the calomel. The leeches were repeated, the calomel ordered every six hours, with half a grain of opium at each dose. [The notes do not state, but probably the calomel had run off by the bowels, and therefore had not affected the mouth; to check the purging, I presume, the opium was added.—J. F. S.] The leeches were repeated in the evening, and the anodyne draught at bed-time.

March 3. Has had a good night and five hours' sleep; pulse continued quick; the wound was dressed, and the leeches applied to the chest, and repeated in the evening; forty drops of laudanum were given at bed-time.

March 4. Has passed a good night; thinks himself better, and that he shall get better if undisturbed. The leeches repeated; the calomel only to be taken twice a day. In the evening his pulse 132; tongue dry and brown. Leeches repeated, and also the night draught.

March 5. Has had a better night than he expected; pulse 120; he complains of soreness of his gums and mouth; wounds in the chest rapidly granulating. Leeches repeated.

March 6. Mouth very sore, specially near the fracture; pulse 134, very weak; tongue moist and less coated. The scalp wound was first dressed, and found to be united throughout; the wound in the chest going on well. The calomel and the anodyne draught continued.

March 7. Has slept well; pulse 120, and fuller; the respiration continues inaudible at the lower part of the left lung, with dulness on percussion; the mouth being less sore the calomel was ordered four times a day; the leeches repeated, and anodyne draught continued. On the following evening he was ordered arrow-root and biscuit powder.

March 9. Better; calomel thrice a day; on the following day only three grains were given, and only twenty-five minims of laudanum given at night.

March 12. Has passed a very good night; says he feels quite well, and is astonished so many inquiries are made about his health. A grain of calomel twice a day; the anodyne at night. Milk, arrow-root, and biscuit powder, as he pleases. From this time he continued improving, till

March 23. When he had a slight rigor; the pulse became very rapid, varying from 140 to 150; tongue dry, and excessive thirst; is very restless, and apprehensive that all is not right; the bowels have not been relieved for two days. Sixteen ounces of blood were taken away, which was rather buffy; a cathartic injection immediately, and a cathartic draught ordered every three hours till the bowels are moved.

March 24. Has slept but little; tongue dry; pulse very quick and weak. Thirty leeches applied to the chest; saline mixture and two grains of calomel every three hours ordered. He was rather better in the evening. Sixteen leeches to the chest.

March 25. His mouth being slightly affected, the calomel was ordered only every six hours, and twelve leeches to the chest. Feels himself better; pulse 118.

March 26. Says he feels quite well again; pulse above 100. This morning for the first time complains of a cough accompanied with tickling in the throat. Twelve leeches to the chest. Two grains of calomel thrice a day; and next day, he complaining of soreness of the mouth, it was ordered only night and morning.

March 28. Says he feels quite hearty again: cough is troublesome; respiration returning in the left lung; very feeble just below the wound on the front of the chest with slight *rhoncus mucosus.* Blanc-manger and a little coffee twice a day.

April 2. Since the last report has been going on as well, except that his bowels have been disposed to costiveness, and it has been therefore necessary to give sulphate of magnesia in peppermint water every three or four hours, and a purging clyster. Complains of his cough becoming more troublesome.

April 4. Has been going back for the last day or two. The cough harasses him very much, and prevents him sleeping: pulse rapid and very weak. The wound in his chest looking well, but a sinus about three inches long passes obliquely outwards between the ribs and skin, which, being laid open, exposed a small portion of the cartilage of the fourth rib.

April 8. Much the same: cough as troublesome: gets but little sleep: pulse 120, feeble. He takes syrup of poppies and squill vinegar three or four times a day, when the cough is urgent. To continue the blanc-manger, milk and broth as he pleases, and have one egg every morning.

April 9. Has had a better night and less cough.

April 12. Going on satisfactorily; says he feels quite himself again; sleeps well; appetite good; pulse about 90.

April 22. Continues improving daily: respiration more audible, except at the lower part of the left lung; pulse perfectly quiet; sleeps well. Allowed table-beer and half a chicken daily. After this time nothing of consequence happened; and on the 30th of May he was convalescent.

The quantity of blood spat up in this case, did not exceed that commonly coughed up in broken ribs. The discharge of pus from the wounds till they had healed was very trifling. The pulsation of the heart was very violent, and distinctly raising the bed-clothes.

He recovered his health perfectly; first went into service as a footman, but returned to the sea, and was twice shipwrecked, and saved his life by swimming a considerable distance. In 1841 he was well, and went a voyage to the West Indies.

Astley Cooper mentions the case of "a man who had been wounded through the intercostal muscles with an iron spindle: the wound healed, but tetanus supervened, of which he died. Upon inspecting the chest after death, the lung was found to have assisted in closing the wound by adhering to the injured pleura." (p. 230.)

Opportunities of examining the condition of wounded lungs after their cure are of rare occurrence. Hennen says he has "never had the opportunity of examining the lungs after recovery from a severe wound." (p. 386.)

An account of such a case has, however, been given by Everard Home (*a*), thirty-two years after the injury had been received. "In searching for the course of the ball, the spot where it entered the lungs of the left side was very readily discovered by the remains of a small cicatrix, the membrane at that part being thinner than common, and having a puckered appearance which terminated in a central point. This part of the

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(*a*) The case of a person who was shot through the lungs and survived for thirty-two years; with an account of the appearance of the contents of the thorax after death; in Trans. of a Society for the improvement of Medical and Chirurgical Knowledge, vol. ii. London, 1800.

lungs had not the slightest adhesion to to the *pleura*, but was in its natural detached state. The course of the ball through the substance of the lungs was readily traced by dissection, for an induration of the substance of the lungs was formed wherever it had passed; this was best seen by making transverse sections of this thickened part. The appearance of the lungs in the right side was of the same kind, but in a less degree. The course of the ball was nearly through the upper lobe of both lungs, at nearly the distance of two inches and a half from the highest part of them where it entered the left lungs. The portion of lungs above the ball did not contain air, but the cells were filled with serum, so that it was more dense than natural, and sunk in water; but this part was not in any degree shrunk or contracted. It had no communication with the branches of the *bronchia*, the adhesive inflammation consequent to the wound having consolidated all the parts above the line through which it passed." (pp. 171, 72.)

Upon this subject see also

BREMOND; in the Mémoires de l'Académie des Sciences, an 1739.

NORRIS; in the Memoirs of the Royal Society of London, vol. iv.

RICHTERS, Chirurgische Bibliothek, vol. iv. p. 695.

ABERNETHY's Surgical Works, vol. ii. p. 178.

WILLIAMS, On the Effect of Air penetrating the Cavities of the Chest in Wounds of the Thorax; in London Medical and Physical Journal, June 1823.

REYBARD, above cited.

[480* In regard to the *prognosis* of wounds of the chest, HENNEN observes:—"I should be unwilling to lull either a patient or a Surgeon into a false security, or to underrate the real danger of any case; but I have seen so many wounds of the thorax, both from pike and sabre thrusts, and from gun-shot, do well ultimately, that I cannot but hold out great hopes, where the *third day has been safely got over*, for though occasional hæmoptysis may come on, at almost any period during a case, and its approach can neither be entirely prevented nor anticipated, the more deadly hæmorrhages are usually within the first forty-eight hours; and yet to this alarming symptom, when within moderate bounds, the safety of the sufferer is often due. Dr. GREGORY of Edinburgh was in the habit of stating in his lectures, that of twenty-six wounds of the thorax received at the battle near Quebec two only were fatal." (pp. 386, 87.)]

481. Penetrating wounds of the chest are most conveniently treated under the following conditions:—1. *Simple penetrating wounds;* 2. *Wounds complicated with the presence of foreign bodies*; 3. ***Penetrating** wounds with bleeding;* 4. ***Penetrating** wounds with protrusion of part of the lungs.*

482. *Simple penetrating Wounds of the Chest*, or those in which the *cavity of the pleura merely is opened*, are rare. Their treatment consists in the speedy closing of the wound, and in the prevention of inflammation. The patient, after a deep inspiration, should expire, and then the wound is to be carefully closed with sticking plaster, covered with a compress, and fastened with a broad chest-bandage and a shoulder-bandage. The patient is to be treated on a strictly antiphlogistic plan. If the inflammation be prevented the wound heals quickly. If inflammation come on and be long continued, consecutive extravasation from exudation of the *pleura* is frequently produced after a lapse of fourteen days, and renders the opening of the cavity of the chest necessary.

483. ***Foreign Bodies***, which complicate penetrating wounds of the chest, are either broken pieces of the injuring instrument, balls, pieces of clothes, driven into the wound, or splinters of the ribs. If the state of the injury do not itself point out the presence of foreign bodies, the symptoms by

which it can be inferred are very equivocal. They excite constant irritation, difficult respiration, pain at the wounded part, even though the most severe antiphlogistic treatment has been long continued; or although the symptoms had diminished, a fresh accession, copious suppuration, and so on, may occur. The circumstances of the accident must be carefully reviewed, in order to determine on the presence and position of the foreign body, which is often most decidedly possible by the introduction of an elastic or metallic sound, for the purpose, either by suitable enlargement, or by a fresh opening in the interspace of the ribs corresponding to its position, when it can be done, to extract it. The longer suppuration is kept up by a foreign body in the cavity of the chest so much more difficult is its extraction, because the interspace is much diminished by the falling together of the ribs. LARREY (*a*) has in one such case cut out the upper edge of the lower rib with the lenticular, as deeply as needful, for the purpose of extracting the ball, and did not wound the intercostal artery.

Bullets may penetrate the chest, run round the lungs, and pass out nearly opposite their point of entrance (1). Instances have occurred in which bullets have lain in the cavity of the chest for a long while, without producing inconvenience; in such cases they have been enclosed in a covering of coagulable lymph, as in a capsule (2).

[(1) See HENNEN's Observations on this point (*par.* 480, *note* 2.)

(2) In one case the ball remained in the substance of the lung for twenty years, the patient continuing in good health, and no symptoms occurring to indicate its position. In another, the ball rolled about in the cavity on every motion of the body (*b*).]

484. In penetrating wounds of the chest bleeding may occur from the *arteria intercostalis*, the *arteria mammaria interna*, from the *lungs*, or from the *great vessels of the chest*. In large and direct wounds the blood flows out freely; if the wound be narrow, if it form a long and, perhaps, curved canal, the blood empties itself into some one space internally, and the quantity poured out is relative to the size of the wounded vessel, and the space in which the effusion has taken place.

485. Under such collection of blood in the cavity of the chest the face is pale, the pulse small and quick, the countenance shrinks, there is singing in the ears, cold sweats over the whole body, exceedingly difficult breathing, danger of suffocation; that side of the chest in which is the extravasation is more full and moves less during respiration; the patient breathes best on his back, with the upper part of his body raised; suffocation threatens if he lie on the sound side. As the extravasation increases, the symptoms become more severe, and the patient dies suffocated.

486. The symptoms of extravasation of blood in the chest are very different, and often very equivocal. If the extravasation be slight, or if it have been slow in its production; if the lung be adherent with the *pleura* to a great extent; if the individual be less sensible on account of the loss of blood; if previous disease of the chest exist; if spasmodic symptoms accompany the injury, then the diagnosis is extremely difficult.

487. The *most certain and determinate signs* of extravasation of blood in the chest are, the continued symptoms of an internal bleeding, difficult, quick and short breathing, with spitting of blood in wounds of the lungs, in which inspiration becomes easier and expiration more difficult, and in sleep threatens suffocation; constant anxiety in a greater or less degree; difficulty or utter incapability of lying on the sound side; a dull

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(*a*) Mémoires de Chirurgie Militaire, vol. iv. p. 250.

(*b*) MANGETUS, Bibliotheca Chirurgica. Geneva, 1721. folio.

sound on percussion of the chest, increasing with the increase of extravasation; the respiratory murmur accompanied with a gurgling murmur, and in a severe case of extravasation subsiding entirely, or perceptible only at the upper part of the chest; a tolerable condition when lying on the back with the chest much raised; irregular action of the heart and pulse; loss of sleep; pale, sparing, and even suppressed urine.

The *less certain and constant symptoms* are, increased expansion of the wounded side of the chest, by which the ribs are separated from each other, and their mobility interfered with; œdematous swelling of the chest (in some parts at least the muscles appear more full); in the greater extent over which the pulsation of the heart can be felt, and its displacement to the opposite side by the pressure of the fluid; a sensation of weight on the chest, or an audible squash on the patient's motions; a swelling beneath the short ribs and in the region of the belly, from depression of the diaphragm; ecchymosis on the short ribs of the injured side, first occurring some days after the accident; œdema of the hand and foot, and redness of the cheek upon the injured side.

488. The existence of extravasation may be distinguished with certainty when the symptoms described, (*par.* 487,) or if not all, yet the most part of them appear together, continue, and increase; if they be unaccompanied with any other organic affection, and do not yield to general treatment in the first twenty-four hours.

489. The blood extravasated into the cavity of the chest operates not only as a mechanical hindrance to respiration by compression of the lungs, so that they gradually lose their cellular character, and unite with the *pleura;* whence it happens that, after long continued extravasation, its discharge is of no use, the lung being no more capable of expanding itself; inflammation of the surface, with which it is in contact, also soon takes place, as the blood operates fatally by its decomposition, though it often continues long in its naturally fluid state. The bleeding must therefore be stanched, the further extravasation be prevented, and the effusion into the chest removed.

["In incised or punctured wounds, hæmorrhage takes place," observes HENNEN, "instantaneously, and profusely; in gun-shot wounds, if the intercostal artery or lungs are only brushed, or some of the more minute vessels opened, it is not so violent; and we have rather to prepare for what may occur on the separation of the eschars, than to combat any existing symptoms, the general tendency to pneumonic inflammation excepted. In the event of secondary bleeding from the lungs themselves, we are in possession of no external means for remedying it; but whenever the tenaculum *can* be used to an injured intercostal artery, it should at once be applied, and the vessel secured by ligature. Unfortunately, however, we but too often are disappointed in finding the source of the hæmorrhage; and here judicious pressure is our only resource. In some slight injuries I have used the graduated compress with success; but if the sloughing is extensive, nothing but the finger of an assistant, relieved as often as occassion may require, and pressing direct upon a compress placed along the course of the vessel, or so disposed as to operate upon its bleeding orifice, will be of any avail." (p. 375.)]

490. It is very difficult in most cases, in many quite impossible, to determine the origin of the bleeding in penetrating wounds of the chest.

491. *Injury of the Intercostal Artery* may be presumed when the wounded person does not spit blood, and when the symptoms of extravasation are urgent. If the wound be large, bright-red but not frothy blood spirts from the wound in an unbroken stream; if the finger be put on the point where the artery is wounded, its spirting may be felt. The wound is directed towards the lower edge of the rib.

The insertion of a gutter-shaped curved piece of card-board, recommended by Richter and others, is useless. The finger alone can distinguish the bleeding vessel, if the blood pour into the cavity of the chest, in which case, in expiration or in coughing, it always flows from the wound in a full stream. In the symptoms already given, it must not, however, be overlooked, that they refer to injury of the intercostal artery alone, but that ordinarily injury of the lung happens at the same time. This objection applies also to the canula proposed by Reybard (*a*), provided at its front end with a lateral aperture to be held against the wounded vessel, and at its hind end connected with a bladder.

[An interesting example of a fatal gun-shot wound of the intercostal artery is given by Graëfe (*b*), which was the cause of considerable dispute on account of the shot not having been found in the neighbourhood of the wound:—

A young man, aged fifteen years, received a discharge of small shot in the chest and belly at the distance of about forty-eight paces. He instantly fell, but soon afterwards got up and ran for about six hundred paces when he again fell exhausted. About an hour afterwards he was discovered and taken home. On examining his person the following external injuries were observed:—1, a small round wound of the form of a middle-sized shot on the right side of the chest near the sternum and the interspace between the first and second ribs; from this wound a quantity of florid blood continued to issue: 2, a wound of about the same size and shape, on the right side of the belly, between the navel and ribs. This wound appeared to be superficial: no blood issued from it: 3, a slight contusion of a circular form on the left side of the belly not far from the navel. He died thirty-eight hours after the receipt of the wound. On *examining* the body and tracing the wound in the chest, the substance of the *m. pectoralis major*, through which the shot had passed, was found filled with thick black blood; a quantity of the same kind of blood continued to escape from the chest through the orifice during the inspection. On laying open the cavity the quantity extravasated amounted to twenty-eight ounces, the greatest quantity being in the right side. The right lung was collapsed, occupying only about one-fourth of its cavity. There was an opening on its anterior surface at the upper part, corresponding to the external wound. From this a canal was traceable for about *an inch and a quarter* into the substance of the right lung backwards; it then passed towards the surface of the organ for about an inch and a-half, and terminated in a *cul de sac*. At the inferior margin of the sixth rib, and at about two inches from its head posteriorly and internally, a lacerated opening of about an inch in depth was discovered. On carefully dissecting this part, the sixth intercostal artery was found torn through, and the muscular structures around filled with blood. No foreign body was here discovered by which the wound might have been caused, nor was there any communication externally and posteriorly, by which such a body might have passed out. The abdominal wound was about the size of a pea; it had penetrated the abdominal cavity, but the *viscera* were uninjured. No shot could be discovered to account for this wound.

The Medical College to which the dispute was referred, after giving a review of the case, decided that "the only wound penetrating the cavity of the chest being that already described as situated anteriorly between the first and second ribs, through this opening the shot must have entered, which produced the deep-seated laceration. From the examination of this wound during life and after death, it is clear that the canal which the shot had formed did not pass horizontally backwards, but in a direction *from above downwards*. Under these circumstances, the part at which the shot would strike posteriorly would be *between the sixth and seventh ribs*. The circumstance of no shot having been found in the neighbourhood of the wound, is no obstacle to the admission of this opinion of its origin; since it is well known that large musket-bullets are often deflected from their course by a slight resistance, and lie concealed in parts remote from the wound. If this be observed with regard to such large masses of lead, *à fortiori* it would take place with small shot.]

492. We are rich in remedies proposed for stanching bleeding from the intercostal artery, but equally poor as to the facts which determine their fitness and applicability. To these belong the tying round of the rib according to Gerard (*c*), Goulard (*d*), and Leber (*e*); the tying the artery (without the rib) by means of an armed needle, jointed at its fore-

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(*a*) Above cited, plate iii. fig. 3.

(*b*) In Henke's Zeitschrift für die Staatsarznei-kunde, 1836, and British and Foreign Medical Review, vol. iii. p. 536. 1837.

(*c*) Dionis, Cours d'Opérations de Chirurgie, par De la Faye, Paris, 1771, p. 341.

(*d*) Mémoires de l'Académie des Sciences, an 1740.

(*e*) Plenck, Sammlung von Beobachtungen, vol. ii. p. 210.

part, after the manner of Reybard and Nevermann (*a*); its immediate ligature proposed by Ben. Bell (*b*); the compression of Lottery (*c*), Quesnay (*d*), Belloq (*e*), and Harder (*f*); the compressors of Desault and Sabatier (*g*), by means of a square piece of linen, of which the middle is so deeply thrust into the wound and fitted with charpie, that if the ends be pulled the middle is pressed as a plug against the artery; or by a proper, thick plug, furnished with a strong thread, passed through the wound, and, by means of the thread brought to the rib. According to Medin the wounded vessel should be completely cut through with a myrtle leaf, pushed back, and a tent pressed upon it. Assalini proposes cutting the artery through, and allowing it to retract; to close the wound carefully, and subsequently to discharge the existing extravasation.

Grossheim (*h*) recommends von Arendt's aneurismal needle. My observations to the contrary are in the *Heidelberger klinischen Annalen* (*i*).

Nevermann (*k*), after enlarging the wound to the intercostal muscles, divides the latter together with the *pleura*, a little from the lower edge of the upper rib for some lines, and introduces a staphyloraphic needle armed with a thread flat into the chest upwards, so that the point of the needle is some lines above the rib; the needle is then drawn round, so that the point readily turns forwards to the incision, and passed with it close to the bone, and specially on its under edge; he then pulls the thread out of the needle's eye, withdraws the needle, and ties together the intercostal artery, vein, and nerve.

493. To employ the greater number of the plans of treatment recommended and above described, for stanching bleeding of the intercostal artery, a large wound is always needed, and if the wound be not large, it must be increased. They are generally to be considered as exceedingly dangerous proceedings, the result of which is always uncertain. If the uncertainty be remembered, in which the Surgeon generally finds himself as to the source of the bleeding, and that in simultaneous injury of the lungs, the bleeding from those organs is increased by the employment of most of these remedies, the application of immediate ligature or of compression must not be unconditionally recommended. Injury of the intercostal artery, near the breast-bone or in the middle of the ribs, where most wounds of the chest occur, does not always produce severe bleeding, as foreign and home practice proves (*l*). The injury of the intercostal artery, near its origin, always indeed causes very dangerous bleeding; but in this case also on account of the depth of the artery, and also the knowledge of the source of the bleeding, is the application of the preceding means difficult and indeed impossible (*m*).

It is most suitable therefore, in bleeding from the intercostal artery, to employ only such treatment as is pursued when the bleeding is from a vessel of the lungs, and to hope that by closing of the wound, by strict antiphlogistic treatment, by cold applications to the chest, by the pressure of the blood retained in the cavity of the chest, the wounded artery will become

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(*a*) Above cited, p. 141, plate iii. fig. 2.

(*b*) System of Surgery, 3rd Edit. Edinburgh, 1787.

(*c*) Mémoires de l'Académie de Chirurgie, vol. ii.

(*d*) Dissertatio de Hæmorrhagia Arteriæ intercostalis sistenda. Berol., 1823.

(*e*) Médecine Opératoire, vol. i. p. 179.

(*f*) Neue Bemerkungen und Erfahrungen. Berlin, 1781, vol. i, p. 59.

(*g*) Manuale de Chirurgia. Milano, 1812.

(*h*) In von Graefe and Walther's Journal.

(*i*) Vol. iii. part ii.

(*k*) Ueber das beste Verfahren, eine Hæmorrhagie der Art. intercostalis nach Verwundungen zu stillen in Berliner Med. Centralzeitung, 6 Aug. 1836.

(*l*) Ravaton, Pratique Moderne de la Chirurgie. Paris, 1785, vol. ii. p. 130. Spiess, above ited.

(*m*) Chelius, Ueber die Verletzung der Art. intercostalis in gerichtlich medicinischer Hinsicht; in Heidelberger klinisch Annalen, vol. i. part iv. also vol. iii. part ii., and in Spies, above cited, See also Von Graëfe, Bericht über das klinische chirurgisch-augenärztliche Institut der Universität zu Berlin für das Jahr 1826. Berlin, 1827. And in Journal für Chirurgie und Augenheilkunde, vol. x. p. 369.

closed with a clot, after which the extravasation may be discharged in the usual way. Only in large, open wounds is the immediate ligature of the intercostal artery possible. If the *pleura* be not wounded at the same time with the intercostal artery, it may be attempted to stanch the bleeding by filling the wound with charpie.

494. *Wounds of the internal Mammary Artery* must be distinguished on anatomical principles and by examination, as in wounded intercostal artery. Between the fifth, sixth, and seventh ribs it must be nearly always accompanied with a division of the rib-cartilage; and it may be wounded without effusion of blood into the cavity of the *pleura.*

What has been said in reference to stanching bleeding from the intercostal, in part, also, applies to that from the mammary artery. It may, perhaps, be taken up on the second, third, and fourth intercostal spaces. As to the other modes of treatment, only compression, by means of folds of linen filled with charpie, and the remedies advised for stanching bleeding from the lungs are to be employed.

495. When *the large vessels in the cavity of the Chest* are wounded, the person dies quickly; only when the wound is small can he live for a little time. If no very large vessel be wounded, the symptoms vary.

If the lungs be wounded at a part where they are connected with the *pleura*, there will not be any effusion into the cavity of the *pleura*, and that space only made by the wounding instrument into the lungs will be filled with blood; it flows out, if the external wound be sufficiently large, or filters into the cells of the lung itself. But if the lung be wounded at an unattached part, the blood will flow into the cavity of the *pleura*, and the symptoms already described will be produced.

496. The stanching of bleeding from wounded lungs can only be effected indirectly.

1. The power of the circulation must be so reduced by the most strict antiphlogistic treatment, by large repeated bleedings, that by the greatest quietude of the patient, by continued use of cold applications to the chest, and cooling medicines, a plug may be formed in the opening of the vessel, which, under the weakened circulation, cannot be thrust out by the force of the moving blood, and consequently the wounded vessel is obliterated. The bleeding must therefore be so often repeated as the pulse begins to rise and to threaten, by the increased motion of the blood, the thrusting out of the just formed clot.

2. The blood must be retained in the cavity of the chest, partly for the purpose of assisting the formation of the plug, partly to prevent its early throwing off. The wound must be therefore, as already said, well closed with sticking plaster. If under this treatment the bleeding stop, of which we become aware by the cessation of the primary symptoms, by the return of the natural warmth, and so on, and the symptoms of extravasation still continue, then, after two or three days, we must proceed to open the cavity of the chest. Only when there is manifest danger of suffocation is this to be done earlier; in which case, however, a repetition of the bleeding is always so much earlier to be feared.

The union of penetrating wounds of the chest, recommended on the grounds just mentioned, is objected to by VERING (*a*), for the following reasons:—" 1. In most penetrating wounds of the chest, injury of the thoracic *viscera* also exists, and if primary bleeding do not at once take place, most commonly, in injury of the lungs, consecutive extravasation occurs. 2. The signs of a penetrating wound are extremely doubtful, and

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(*a*) Above cited, p. 32.

equally so are those of extravasation; they may be so complicated with the constitution of the patient, with organic disease of the chest, with nervous causes, with supervening inflammation, and so on, as to render the most acute practitioner doubtful. Such stabs of the chest only are, therefore, to be considered simple wounds, in which the most careful examination does not prove penetration. In all vertical and oblique wounds, however, in which the examination gives no certain grounds, or when the wound has certainly penetrated; further, in those wounds where local examination has not proved penetration, but when, either immediately or some hours after the injury, only some symptoms of extravasation or of internal injury begin to appear, *the wound is to be enlarged not only to its very bottom but, if it penetrate, also through the pleura.* A correct knowledge of the direction of the wound is thereby obtained, air and blood can freely escape, all infiltration is prevented, all the symptoms may be attacked as they arise, and if there be no internal injury nor extravasation, the wound may be closed. But wounds in the neighbourhood of the spine or *sternum* must be treated as simple wounds, and, if symptoms of extravasation come on, an opening into the chest must at once be made in the usual place."

To this mode of treatment, it may be objected that the closure of the wound is, in many cases, the only mode of stanching bleeding from the lungs; that in many cases of penetrating wounds of the chest, even with injury of the lungs, a cure without extravasation follows, or the effused blood is absorbed, of which experience refers to many cases; that consecutive extravasation certainly occurs earlier when the wound is enlarged, because the inflammation of the lungs and *pleura* is thereby rendered more severe. It is, therefore, generally more advisable to close the wound, and only to have recourse to its enlargement if it be not too high on the chest, pretty nearly midway between the spine and the breast-bone, and the medical attendant must be guided by the symptoms of extravasation as to opening the cavity of the chest. The enlargement of the wound is to be made either upon the finger or on the director, and always in such direction that the lower edge of the rib be avoided, and the cut have a conical form towards the *pleura.* The further treatment is the same as that already stated in reference to opening the cavity of the chest.

These reasons are also opposed to Reybard's (*a*) recommendation of introducing into the chest a canula with a bladder, around which the wound is to be closed with sticking plaster; and in this way both the air collected in the cavity of the chest and the extravasated blood are to be discharged.

[Astley Cooper says that danger in three ways results from wounds of the lung; *first,* from hæmorrhage; *secondly,* from inflammation of the lung, and effusion into the cavity of the *pleura*; and *thirdly,* from emphysema. As to their treatment he states that

In hæmorrhage "the patient must be freely bled to prevent the continuance of the hæmorrhage from the wounded lung, and the opening must *not be closed in the parietes,* until all the bleeding from the lungs have ceased, otherwise the blood will remain in the cavity of the chest, and produce irritation and inflammation." (p. 230, 31.)

Hennen observes on the same point:—"In whatever part of the thorax a ball, bayonet or sabre strikes, our first object is to diminish the quantity of circulating blood, so vast a proportion of which passes through the contents of the cavity. On this the very existence of our patient depends, and we cannot from reasoning *à priori* fix any bounds to the quantity to be taken, or determine the intervals at which it is to flow: our practice in both respects must be governed by the effects. * * * The mode to be instantly, adopted in these cases is as follows:—Without searching after balls or fragments of bone, or attempting to ascertain the precise track of the bayonet or pike, or expatiating on the particular vessels or their branches, which may be injured, let the man lie quietly along, and lose from thirty to forty ounces of blood from his arm by a large orifice. This done we should remove the clothes or handkerchief, which may have been put hurriedly over the wound to stanch the blood. If he has fainted during the bleeding, or if we find him in that state when we arrive, instead of administering any cordials to him, we should put our finger into the wound, and extract everything within reach, whether cloth, ball, iron, splinters of bone, or clots of blood. If the orifice be not sufficiently large, we must not be afraid of making it moderately larger by the cautious use of a probe-pointed bistoury, or the sharp one with a small morsel of wax on the end of it. By this means we make way for the removal of extraneous bodies, and may possibly discover the bleeding orifice of one of the intercostal arteries, which sometimes are cut, but *not at all so often* as speculative writers would lead us to believe." If it be a gun-shot a mild light dressing is sufficient; "but if incised the lips should be closed

(*a*) Above cited.

at once; and this treatment will be found to afford the most certain preventive to emphysema, future hæmorrhage or collections of matter. I scarcely recollect an instance where it was necessary to remove the adhesive straps, or (where it was gun-shot) the usual dressings." The patient is to be left quiet, in a cool place, and often needs no further aid; "but if the case is very severe, he will possibly lie for some hours in a state of comparative ease, till the vessels again pour forth their contents, and induce fresh spitting of bloody froth, and a repetition of all the symptoms of approaching suffocation. The lancet must again be had recourse to; and, if by this management, repeated as often as circumstances demand, the patient survives the first twelve hours, hopes may begin to be entertained of his recovery from the immediate effects of the hæmorrhage. In the after-treatment of a wound of the nature here described, we shall be considerably assisted by the aid of medicine, but until the danger of immediate death from hæmorrhage is over we must not think of employing anything, except depletion, by the lancet; it and it only can save the life of the wounded man." (pp. 372, 73.)]

497. *Emphysema* is that swelling which arises from the escape of air into the cellular tissue. It only rarely occurs in large and direct wounds; more commonly in those of which the external opening is not wide, and which have an oblique direction, as in stabs; and it is very common in broken ribs, when the bony points penetrate the lungs, and in shot-wounds, on account of the great swelling which closes the external opening.

498. Emphysema takes place when the air penetrates through the external wound into the chest, and on account of the outer and inner wound not being parallel, is driven into the cellular tissue; or in wounds of the lungs when the air is driven through the cells of the lungs into the cavity of the pleura, and thence through the wound into the cellular tissue. In the former case the swelling is not large, and does not spread beyond the circumference of the wound; in the latter the swelling is much more extensive and may spread over all parts of the body, the palms of the hand and the soles of the feet excepted, in consequence of which the patient has a frightful appearance. Emphysema is readily distinguished from all other swellings by the natural colour of the skin covering it, and by its peculiar crackling sensation when touched.

["Emphysema, the third consequence of wounded lungs, is," says ASTLEY COOPER, "less dangerous than the others. It sometimes extends to the face, covering the neck and also a large part of the trunk." (p. 232.) HENNEN observes that in military surgery emphysema "does not occur perhaps in one case of fifty, and that, in a great proportion of those where it does take place, under judicious treatment it is trifling. Sometimes, however, it is indeed tremendous in appearance, and most distressing in reality. * * * I have seen a bayonet thrust in the chest, where all distinction of chin, neck, and chest were confounded in one general and unbroken surface; and it has been found that the air has entered the more condensed cellular substance, forming the envelopes of the different organs, and even into the substance of the *viscera* themselves: one proper application of the scalpel would have prevented it all." (p. 376.)

I have seen one case of emphysema, merely from broken ribs, much like that mentioned by HENNEN, in which the whole upper part of the chest, the neck, and head were swollen so much, and the features so destroyed, that together they were as formless as, and had a great resemblance to a large loaf which had been soaked in water. A few punctures, however, gradually voided the air, and the patient did well.—J. F. S.]

499. When the air escapes from the lungs into the cavity of the pleura, and there collects, the same symptoms of compression of the lungs are produced as in extravasation of blood. Breathing is disturbed, and becomes extraordinarily difficult; the patient sits up, and bends forwards; the countenance becomes reddened and swollen, the pulse small and contracted; the extremities cold, and the oppression will quickly destroy the patient.

[HENNEN relates a very remarkable case of *secondary emphysema*, in a soldier who was shot by a rifle bullet, which entered a little above and behind the articulation of the left clavicle with the scapula, in front of the edge of the *m. trapezius*, passed apparently across the back, and was cut out forty-eight hours after, below and behind the right acromeon. About ten minutes after blood flowed copiously from the mouth on turning from side to side, and was brought up by hawking or coughing slightly. About the same time also air was discharged from the orifice, and continued to be so whilst the wound remained open. In about five months the wound had healed, several spicula of bone having been discharged during the cure. Some time after, whilst exercising with the dumb-bells, "air was forced from the chest among the soft parts on the left side of the neck and the posterior part of the shoulder, and was easily recognised by the *emphysematous crepitus*. This spread considerably, became painful on pressure, and his breathing was difficult and attended with great pain on the left side of his chest." An incision was made, a large quantity of purulent matter and air discharged, but after two months it healed. A month after the air re-appeared, and the dyspnœa and pain recurred; subsequently also severe cough and expectoration of mucus streaked with blood. When he coughs or shuts the glottis and makes an effort to expire, a sudden croaking noise is produced, which can be heard at a considerable distance, and on placing the hand at the root of the neck at these times, the soft parts are felt to be suddenly distended, and to communicate a feeling of crepitation, which continues at all times to a greater or less degree in the neighbourhood of the wound. This noise, and the accompanying escape of air, can be prevented by pressure with the point of the finger in the course of the first ribs, a little above and nearer to the spine than the cicatrix of the original wound." An incision made into the root of the neck discharged only a little air, and did not afford much relief. He sunk, and died hectic. *Examination.*—The cavity of the chest diminished; the lungs on both sides adhering very firmly to the *pleuræ;* their structure firmer, and their air-cells almost obliterated; the *bronchi* filled with puriform mucus. "At the upper and posterior part of the left side of the thorax a cavity, between the surfaces of the *pleura pulmonalis* and *costalis*, capable of containing from ten to twelve cubic inches of air, and thickly lined with coagulable lymph, particularly where the lungs adhered to the parietes of the chest, and containing only a small quantity of pus. Two small openings were observable at the upper part of the cavity, penetrating through the *pleura costalis*, between the second and third ribs, and communicating with an abscess which existed in the upper and back part of the shoulder, immediately beneath the skin, and extending several inches backwards and downwards from the external wound. The second rib had been fractured, much callus had been thrown out for its re-union, and a part of it was bare." (p. 380–83.)]

500. If the emphysema be not very great, merely confined to the neighbourhood of the wound, it may be got rid of by the application of dispersing remedies. If it be greater, and raise the skin from the muscles, deep scarifications must be made in different parts, and the air discharged by squeezing. If suffocation threaten, the wound must be enlarged or a fresh but direct one made into the chest, by which the air passing from the lungs may freely escape. By enlarging the wound, or by opening the chest at another place, merely pressure on the lungs is prevented. **Abernethy** (*a*) considers the application of a broad chest-bandage especially advantageous in emphysema, in order to prevent the motions of the chest.

The practice of sucking, (*pansement à secret,*) pumping, and so on (*b*), to draw out the air collected in the cavity of the chest, as well as any extravasation, is doubtful and dangerous; for, so long as the wound in the lung is not healed, the air soon again collects, a bleeding scarcely stanched is thereby renewed, and opportunity is given for collapse of the lung; the same also applies to the detachment of the plug. If the air pass out freely from the wound, the pressure upon the lungs and diaphragm can never be very great. The air remaining in the cavity of the chest is soon absorbed.

["In whatever proportion," says **Hennen**, "the effusion of air (into the chest) may be, the wounded lung is incapable of perfectly performing its functions; did it dilate and contract by the inhalation and expiration of air, it never could heal at all. Fortunately it lies for the most part sunk, and always quiescent; and when the wound in its parenchymatous substance coalesces, it gradually extends so as to fill, as it origi-

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(*a*) Above cited, p. 183.

(*b*) **Anel**, l'Art de sucer les Plaies sans se servir de la Bouche d'un Homme. Amsterdam, 1707. 8vo.—**Ludwig**, Progr. de Suctione Vulnerum Pectoris. Lips., 1768. 8vo.

nally did, the side of the chest to which it belongs. Whenever the orifice in the teguments is open, the air has a free passage through it, and continues to be forced out at every attempt at expiration until the process of adhesion has taken place, if not prevented by art. If the lung lies collapsed at the bottom of the thoracic cavity, and that the external wound is healed up before it has resumed its natural inflated state, any small portion of air that may remain there is soon decomposed or absorbed. In many cases, however, where adhesion exists, or has subsequently taken place, between the wounded lung and the thoracic *pleura*, air in small quantities continues to be discharged through the external orifice, (whenever the dressings are removed,) until it is perfectly healed, without any serious inconvenience to the patient." (pp. 377, 78.)]

501. *Protrusion of a Portion of the Lung in Wounds of the Chest* is rare. It cannot arise, as has been falsely held (*a*), from expansion of the lungs, but from the air in expiration streaming violently out of the wound, which, as it is partially behind the lungs, forces, by its violent escape, the edge of one or other lobe of the lung into the wound. At least in animals I have never seen any other part protruded (*b*). If the protrusion be recent, the lung healthy, and the condition of the wound permit, it must as quickly as possible be gently returned. In general it is necessary to enlarge the wound for this purpose. To prevent its reprotrusion, the wound must be properly closed and covered with a compress, which is to be fastened with a bandage. If the protrusion have existed long, if the protruded part be in a state of gangrene from the constriction, a ligature must be put on its base, and the protruded gangrenous part cut off in front, or left to itself.

["The sinking of the lung is not," according to Hennen, "an uniform consequence of a penetrating wound of the thorax. We have sometimes ocular proof of this, not only by the close contact in which the lungs lie to the wound, discoverable at first sight, but by protrusions which occasionally happen, and which, in the hands of the older surgeons, were removed by the knife,—a practice now rejected, and gentle pressure substituted." (p. 378.)]

502. *Inflammation of the Lungs and Pleura*, which are always to be feared in penetrating wounds of the chest must be prevented or moderated by the strictest antiphlogistic treatment. The patient must be kept in the greatest bodily and mental quiet; he must not speak; and take only cooling drinks and food. Nitre is to be given internally, attention paid to keeping the bowels open, and repetition of the bleeding as often and as largely as the condition of the patient may seem to require.

Inflammation of the lungs and *pleura* may proceed to infiltration of the lungs with blood, to suppuration, or serous effusion into the cavity of the *pleura*. The suppuration of the lungs forms an abscess, which empties itself either by the mouth or into the cavity of the chest. In the latter case, and in serous collections in the cavities of the *pleura*, symptoms of extravasation appear, and opening the chest becomes necessary.

["*Inflammation of the lung*," says Astley Cooper, "is to be guarded against by large and repeated bleedings, determined by the dyspnœa and hardness of the pulse; but there is little danger of bleeding too much in one of these cases, as it is an object not only to diminish the force of the circulation, but the quantity of blood in the pulmonary vessels. If *effusion* follows, it is the result of neglected inflammation, or of having closed the external wound too early. In the one case it is a purulent secretion; in the other a bloody serum, which produces the dyspnœa some days after the accident. For effusion into the chest, it is right to perform the operation for *paracentesis thoracis*, to draw off the pus or bloody serum which has collected. * * * In old persons there is great danger in fractured ribs with wounded lungs, and I always give a guarded opinion, for I have seen several die from effusion of fluid into the cellular tissue of the lung. The greatest

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(*a*) Richter, Anfangsgründe, vol. iv. p. 441.—Mayow, De Respiratione, Lugd.Batav., 1671, p. 5.—Halliday, Observations on Emphysema. London, 1807.

(*b*) Spiess, above cited.

care and quiet are therefore required in such a case, and it is better to give digitalis than to bleeding very largely." (pp. 231, 32.)]

503. The symptoms of inflammation of the lungs and pleura, when they become severe, have great resemblance to those of extravasation. The circumstance distinguishing them is, that the symptoms of inflammation diminish after properly employing antiphlogistic treatment, whilst those of extravasation continue or increase.

504. *Wounds of the Heart* are fatal, either suddenly by the bleeding, or the danger depends on the contraction of its fibres, if only some of them be divided, on the collection of blood in the pericardium, and on the difficulty of cure from want of rest, and the consequent addition and extension of inflammation. Only slight wounds of the pericardium and of the heart are curable when the inflammation has not been great; at least distinct scars from previous injuries have been observed on the pericardium and on the surface of the heart (*a*). Cases, however, have occurred of wounds of the heart which have healed, in which several days after the injury and independent of it, death has taken place, and the bullet been found in the heart (*b*).

We presume that the heart is wounded from the direction and depth of the wound. The peculiar symptoms given of this injury are, a more or less severe pain in the region of the heart, extraordinary restlessness, and insupportable anguish; irregular intermitting pulse; cold extremities, cold sweat, and frequent faintings. The bleeding varies as the wound is superficial or deep; in both cases it may be absent on account of the peculiar contraction of the muscles, especially in oblique wounds. The blood either pours forth externally, or into the pericardium, or into the chest, with symptoms of extravasation and of internal bleeding. Special symptoms of wound of the pericardium and of the surface of the heart are not describable, and equally indistinguishable are the symptoms of the parts wounded. Perhaps the different colour of the blood in wound of the left and right side of the heart might render a diagnosis probable. The right ventricle is most frequently wounded. Wounds of the arteries are as dangerous as those of the ventricles; in them a small wound may be closed by contraction of the muscular fibres.

SPEYER (*c*) distinguishes the peculiar causes of death at these different periods in which it follows wounds of the heart; when death occurs early the cause is to be found in the heart itself, but in the more slow and subsequently occurring death the collection of blood in the brain and apoplexy are the cause.

[The following is an example of speedy death after wound of the heart (*d*). A man was jammed between two carts, taken up senseless, and dead by the time he had been brought to the hospital. On *examination*, the whole surface of the chest was found ecchymosed; the eighth and ninth ribs broken and depressed; the cavity of the left *pleura* contained a large quantity of dark-coloured liquid and grumous blood; the lung pushed upwards and inwards, and the diaphragm downwards. The *pericardium* was slit on its left side to the extent of two inches, and contained a small quantity of black coagulated blood. The heart presented at its hind surface a transverse wound corresponding to that in the *pericardium*, an inch and a half long, and penetrating both ventricles, which had doubtless been caused by the broken ends of the eighth rib, which protruded into the cavity of the chest. The lung and diaphragm were ecchymosed, but not wounded. The left hypochondrion contained extravasated blood from a transverse lacerated wound of the spleen. The liver and all the abdominal *viscera* were both rather pale and bloodless. (p. 752.)

(*a*) RICHERAND, Nosographie Chirurgicale, vol. iv. p. 3.

(*b*) Dict. des Sciences Médicales, vol. iv. p. 217. PENADA, Saggi scientifici e litterari di Padova, 1794, vol. iii. part ii. p. 60.

(*c*) Ueber die Ursache der Todlichkeit eindrungender Herzwunden; in the Heidelberger medicinischen Annalen, vol. iv. part iii. p. 259.

(*d*) Case of Wound of the Heart by a Fragment of a Rib; in Lancet 1829–30, vol. ii.

In **Featherstone**'s case (*a*) of the soldier who slipped, and falling upon his bayonet wounded the muscular substance of the left ventricle, lived only forty-nine hours, two quarts of blood were effused into the cavity of the chest, the *pericardium* was nearly filled with blood, and had a puncture which extended three-quarters of an inch into the muscular substance of the left ventricle about two inches from its apex. On opening the ventricle the bayonet was found to have penetrated its cavity, and to have cut through one of the fleshy columns of the mitral valve. A small coagulum was formed at the edge of the wound through the *pericardium*. Upon this case **Featherstone** observes that "death in this case, it is perfectly evident, was not produced from any alarm excited in the system by the wound, but occurred as a secondary consequence from the hæmorrhage increasing to such an extent as to interrupt the action of the heart and lungs. That the hæmorrhage proceeded chiefly from the heart must be admitted; there was no symptom whatever that indicated a wound of the lung; none could be found in the most deliberate examination; and the intercostal artery was entirely free from injury."

In Dr. **Babington**'s case (*b*), the marine who fell from the gangway on his bayonet, which pierced through the heart besides wounding other *viscera*, died in less than twenty-four hours. The emphysema which had commenced early at the upper part of the chest gradually augmented, and, about three hours before death, had reached the head and face, and before he died had extended over the whole body. The external wound was midway between the spine and white line, and the last rib and crest of the ileum; thence the bayonet had passed through the sigmoid flexure of the colon, through the stomach two inches from the *pylorus*; thence through the left lobe of the liver, through the centre of the tendon of the diaphragm and the *pericardium*; then through the heart near the tricuspid valve, through the lungs, and out of the right side of the chest, between the cartilages of the second and third ribs terminating in the substance of the pectoral muscle. In the belly there was a little bloody serum; in the *pericardium* a small quantity of blood, but in the right *pleura* two quarts of the latter fluid.

In another case (*c*), where there was laceration of the *pericardium*, and a superficial wound of the heart, the patient who had been thrust against a wall by the shaft of a cart, lived twelve days. The sternum was fractured, and on examination its upper part was found protruding into the *pericardium*, and to have lacerated the right ventricle through nearly a third of its substance. There was not any fluid in the *pericardium*, but its inner surface was lined with false membrane. The heart itself pale, and its substance very friable. The right fourth, fifth and sixth ribs were fractured; a large quantity of blood extravasated in the *pleural* cavity on that side, and the lung pushed upwards.

Sometimes extraneous bodies remain lodged in the heart, as in the following instances. **Hennen** says he has "seen a preparation of a pin lodged in the human heart (but without any trace of how it got there.) The patient had complained of pain in his chest about three months previous to his death, and died of carditis. On *examination*, immense thickening and enlargement of the organ, with extensive effusion of coagulable lymph upon its surface, and adhesion to the pericardium was discovered." (p. 396.)

Fournier mentions (*d*) the case of a soldier who received a gun-shot wound of the chest, and was taken up for dead, on account of the severe bleeding which had occurred. By great care the flow of blood began to diminish on the third day; his strength insensibly increased, suppuration came on, and many splinters of bone exfoliated. After three months the wound was healed; the patient's health restored, without other inconvenience than frequent palpitations of the heart, which harassed him for three years. During the following three years they became less troublesome, and he then died of disease unconnected with the heart. On examination the cicatrix was found very deep, with loss of substance of the fractured rib. The ball was found lodged in the right ventricle of the heart near its tip, enfolded in a great measure in the *pericardium*, and resting on the *septum medium*." (pp. 396, 97.)

Ploucquet also recites a case where a ball lodged in the anterior ventricle of the human heart, where it is said to have remained for years.]

Compare also **Dupuytren**, Leçons Orales de Clinique Chirurgicale, vol. ii. p. 157.

Lees; in Dublin Journal. May, 1837.

Steiffensand, Ueber Herzwunden und Blut Extravasat in der Brusthöhlt; in **Caspar**'s Wochenshrift. 1838. No. 15.

De Jong, Diss. de Vulneribus Cordis. Gröning, 1838.

(*a*) Med. Chir. Trans., vol. ii.

(*b*) Medical Records and Researches.

(*c*) Répert Génér. de **Breschet**.

(*d*) Cas Rare; in Dict. des Sciences Médicales.

Jobert, Réflexions sur les Plaies Pénétrantes du Cœur; in the Archives Générales de Médecine. Sept. 1839.

505. Only the most strict antiphlogistic treatment can in these wounds be employed. If extravasation into the pericardium take place, the making an aperture in it is the only although very doubtful remedy.

[505.* Wounds of the *pericardium* sometimes occur without injury of the heart, and may be fatal (1) or not (2).

(1) **Astley Cooper** mentions a case in which a man was "wounded by another with a reaping-hook deeply through the cartilages of the ribs. The wound was small, but deep; and the man had the appearance of one who had sustained a dangerous injury. In two or three days after he had much pain in the region of the heart; a quick small pulse. In a few days more he began to swell, and could not lie down in bed. I forget how long he lived, but think for a fortnight or three weeks; and after his death, it was discovered that the hook had passed through the cartilages of the ribs into the *pericardium*, in which there was an effusion of bloody pus." (p. 232.)

(2) **Hennen** relates a case of a bayonet wound of the *pericardium* and diaphragm. The patient recovered of the immediate effects of the injury, and died three months after of pneumonia. The aperture was large enough to admit the finger, and through it protruded a fatty pellicle or tongue fully an inch long and the fifth of an inch wide, convex and lobulated in front, but smooth and flat behind, and originating from the front of the heart an inch and a-half from its tip. A little above this the heart was connected to the *pericardium* by long, broad, and strong fibrous bands, evidently the result of inflammation long before his last illness. (pp. 397, 98.)]

506. *Injuries of the Gullet, Thoracic Duct, Diaphragm*, and *Spinal Marrow*, may be connected with penetrating wounds of the chest. As in these cases there must be always at the same time injury of the most highly important parts, the mortal result is usually not to be prevented. Wounds of the diaphragm, especially of its tendinous part, are always acccompanied with the most severe pain, anxiety, cramps, and convulsions, against which a strictly antiphlogistic treatment must be employed. If the wound in the diaphragm be large, the intestines of the belly may pass through the opening into the cavity of the chest.

Upon injuries of the spinal marrow, compare **Caspar** in **Rust's** Magazin, vol. xiv. part iii. p. 409.

V.—OF WOUNDS OF THE BELLY.

Travers, Benjamin, An Inquiry into the Process of Nature in repairing Injuries of the Intestines; illustrating the Treatment of Penetrating Wounds and Strangulated Hernia. London, 1812. 8vo.

Scarpa, Sull' Ernie, Memorie Anatomico-Chirurgiche. Milan, 1809. fol.—The same translated. A Treatise on Hernia, with Notes, by J. H. **Wishart**. Edinb., 1814. 8vo.

Fingerhuth, Dissert. de Vulnerum in Intestinis Sutura. Bonn, 1827.

Jobert, A. J., Traité Théorique et Pratique des Maladies Chirurgicales du Canal Intestinal. Paris, 1829. vol. i. p. 52.

Weber, H. L., De Curandis Intestinorum Vulneribus. Accedunt quædam Plagis Ventriculi atque Abdominis. Berol., 1830. 4to.

507. *Wounds of the Belly (Vulnera Abdominis)* are, 1, *Superficial;* 2, *Simply Penetrating;* 3, *Penetrating, connected with injury of the Organs of Digestion, or of the Uropoietic System.*

508. *Superficial Wounds of the Belly.* These are distinguished by some peculiar symptoms from the superficial wounds of other parts.

In injury of the tendinous sheaths of the abdominal muscles, especially from oblique stabs, severe inflammation, fever, pain, and vomiting quickly, occur, and the inflammation often spreads considerably. Only strict antiphlogistic *treatment* and enlargement of the wound can remove these symptoms.

Bruises of the belly produce, by the concussion of the intestines, severe symptoms, as violent pain and tension of the belly, fever, often tearing of some intestine, extravasation into the cavity of the belly, and speedy death. Exudation of blood, or actual tearing of the vessels, may subsequently be produced, by gorging with blood of the vessels weakened by the shock. Here at first is indicated the most strict antiphlogistic *treatment*, often repeated bleedings, leeches, cold applications, cupping, and subsequently exciting remedies, infriction of volatile ointments, lotions of alcohol and caustic *liquor ammoniæ*, application of aromatic herbs, and the administration of arnica internally. In bruises of the belly the muscles are often torn, whilst the skin remains uninjured; in such cases, during the treatment, and after the consequent cure, pressure must be employed, to prevent the occurrence of rupture. The same caution is necessary in all wounds which penetrate the muscles; the patient must be put in such position as will entirely relax the abdominal coverings, and the union of the wound properly assisted by a broad belly-bandage.

If connected with the wound there be bleeding from the epigastric, internal mammary, or abdominal artery, it must be stanched, if possible, by ligature, for which purpose enlargement of the wound is requisite, or by pressure.

[TRAVERS asserts that "where the integrity of the abdominal parietes is preserved, as in those which he has denominated simple wound, it is remarkable that effusion more generally follows. These are ruptures of the bowel, produced by falls or blows upon the belly, where the integuments are even unabraded." (p. 36.)]

509. All wounds of the belly, even when superficial, must be treated antiphlogistically, because the inflammation easily spreads to the *peritoneum* If suppuration occur in the wound, the pus may collect in the cellular interstices of the muscles in their aponeurotic sheaths, or between the *peritoneum* and the abdominal muscles. Pain arises therefrom, and a more or less deep-seated swelling, with distinct or indistinct fluctuation. In such cases the wound must be either enlarged in the manner already described, or the pus must be discharged at the most prominent part of the swelling, by a proper opening, and the abscess treated according to the general rules.

510. *Penetrating Wounds of the Belly.* If wounds of the belly be not large and direct, the bowels or caul do not project, and neither fæces, bile, nor any stercoraceous gas escapes through the wound, it is difficult to determine whether they penetrate or not, for observation of the depth and direction in which the injuring instrument enters, so far as the introduction of a probe will show, is not always certain (1). The general symptoms also which usually accompany penetrating wounds of the belly, as small, weak, contracted pulse, pallid countenance, coldness of the extremities, great weakness, hiccough, vomiting, and swelling of the belly, are not always certain signs, as they occur also in sensitive, faint-hearted persons, in simple superficial wounds of the belly. In large penetrating wounds we are directed by the sight and touch.

[(1) The escape of the intestines from injury in penetrating wounds of the belly is very remarkable. HENNEN says he has "seen several; among others, he has been witness to the recovery of a soldier who had been shot through the *abdomen* by a ramrod, which passed in anteriorly, and actually stuck in one of the transverse processes of the *vertebræ*, from which it was not disengaged without the application of some force. This occurrence took place before Badajos in 1812." (p. 402.) The following, also, is a very striking example of the same kind, although fatal:—

CASE.—H. D., aged fifty-two, was admitted under my colleague GREEN, *Oct.* 8, 1829. Having fallen from a ladder, a height of twenty-six feet, upon some cast-iron railing, two spikes of which were broken by his fall; one was taken out of his body, but the other could not be found. There were two wounds in the belly, one just above the navel, and the other, out of which the spike had been taken, just above the left hip-bone. He had also a wound in the right arm behind the middle of the *m. biceps flexor cubiti.* He was much depressed, but after a time rallied a little. During the night he vomited, and next day, reaction having come on, he had pain and tenderness of the belly; but he soon failed again. Brandy was given, and leeches applied to the belly. No stool. On the third day the tenderness continued, and over the left ilio-pubic region there was a considerable inflammation, to relieve which leeches were again applied. In the afternoon he had a copious liquid motion, and in the evening several more very copious and offensive. At half past 11, P.M., he died. On examination, the *omentum* was found adherent to the wound; the intestines smeared with blood, and on raising them the cavity of the pelvis was seen full of blood; the broken spike, having passed without injuring *any of the viscera,* had torn the right common iliac vein, deeply indented the third lumbar *vertebra,* and lay across the *rectum.* No marks of peritoneal inflammation.]

511. This uncertainty is, in simple wounds, of no great consequence, and repeated examination with the probe is not needed, as very simple *treatment* is required. The opening is to be covered with sticking plaster, and a compress and belly bandage applied. In cut and torn wounds, the mode of their union depends on their extent and direction. Longitudinal and transverse wounds, if small, may always be united by the application of sticking plaster, compress, and a belly-band, or SIEBOLD's bandage. In large transverse wounds, in which the intestines cannot be otherwise retained, *stitching of the belly* (*gastroraphia*) is necessary.

["Inquiries into the natural situation and extent of a wound of the abdomen," says TRAVERS, "and the circumstances under which it was received, particularly the fulness or otherwise of the stomach, are chiefly important, as they enable the practitioner to study with effect, and follow up with advantage the operations of nature. It is almost needless to insist upon the impropriety of probing or dilating the wound, formerly a prevailing practice, and of applying adhesive straps and rollers round the belly, in place of warm emollient poultices and fomentations." (p. 74.)]

512. For union of wounds of the abdominal walls the twisted, interrupted and loop stitch are employed. The former effects the closest union, but the latter is suitable in all cases.

Stitching up the belly is always to be considered as an important matter; it easily causes a dangerous degree of inflammation, hiccough, vomiting, and so on. The dread of these occurrences and the numerous cases in which healing of the most severe wounds of the belly have taken place without stitching, must restrict its use. It must not, however, be overlooked that in some wounds of the belly, though not large, the union cannot be certainly effected without stitches, as in such cases the sticking plaster and bandages are easily displaced by the enlargement of the belly, which usually takes place by pressure, vomiting, and so on, and protrusion or squeezing of the bowel into the wound ensues.

513. The employment of the stitch differs according as the threads penetrate the *peritoneum,* or only external to it, through the muscles and skin. In the latter case, as many sufficiently long and somewhat flattened threads are to be taken as stitches are required, furnished at one end with a pretty large curved and sharp-cutting needle. The edge of the wound is to be held between the fore finger of the left hand, introduced into the belly, and the thumb placed outside of it, and drawn somewhat towards the operator;

the needle is held with the thumb of the right hand on the concave, and the fore finger on the convex part, to the very tip, so as to cover it completely. The needle, thus held, is to be introduced into the wound, and placed close to the muscular surface of the *peritoneum;* the fore finger of the right hand is to be somewhat drawn back, and placed obliquely across the convexity of the needle, which is now to be thrust from within outwards, at a greater or less distance from the edge of the wound, according to its different size. In this way the other needles are to be passed through the opposite edges of the wound. So many stitches are to be put in, at equal distances, as the extent of the wound may seem to require. An assistant then brings the two edges of the wound into contact, with his hands laid flat, and the Surgeon ties the threads together with a simple knot, and a loop. For the support of the union, strips of sticking plaster are to be applied in the interspaces, which are most advantageously carried round the whole belly, crossed on the wound, and the ends applied in opposite directions. The wound is to be covered with a pad and compress, and the whole supported with a belly-bandage. The position of the patient must also be such that the walls of the belly should be loose, and the edges of the wound as little stretched as possible.

514. According to GRAËFE (*a*), the traumatic reaction occurs equally whether the suture perforate the peritoneum or not; but in the latter case the wound is always less perfectly closed within. Instead of the fine flat thread he uses a soft tape, a line and a half in breadth, provided at each end with a flat needle, having a double cutting edge in front, and a transverse eye, at which part the thread must be well flattened and oiled. The needle is to be held with the thumb, middle, and fore finger, not far from its eye, and pressed, in like manner, with its convex surface on the front of the fore finger of the other hand, so that the point and cutting edges may be covered. The needle is then introduced within the belly, placed against the *peritoneum*, half an inch from the edge of the wound, and the wounded surface being stretched by an assistant, and inclined somewhat outwards, the needle is to be thrust obliquely from within outwards with a sudden thrust; and then the same is with the other needle upon the opposite side. The union is to be assisted with circular sticking plasters, and so on, as in the previous case.

Compare also WEBER, above cited, p. 39.

515. The *treatment* of all penetrating wounds of the belly must be strictly antiphlogistic. Repeated bleedings, quiet, great abstemiousness, and simple mild drinks must be employed. The dressing should be simple, and should be renewed as rarely as possible. If stitching have been employed, the threads must be removed when it is presumed that union has taken place (from the sixth to the eighth day); but the union must be supported with sticking plaster and bandage, till the scar is completely perfected. In order to prevent a rupture after the cure is effected, the place of the scar must be always supported with proper pressure. If after union of the wound of the belly with stitches, vomiting and hiccough occur, if the wound inflame smartly, and these symptoms do not yield to the antiphlogistic treatment, and to the use of opium, the threads must be loosened or entirely removed, and the wound merely held together with sticking plaster and bandage.

(*a*) Ueber Minderung der Gefahr beim Kaiserschnitte; in the Journal für Chirurgie und Augenheilkunde, vol ix. part i.

["In a penetrating wound of the abdomen," says **Hennen**, "whether by gun-shot or by a cutting instrument, if no protrusion of intestine take place, and this, it must be observed, in musket or pistol wounds rarely occurs, the lancet, with its powerful concomitants, abstinence and rest, particularly in the supine posture, are our chief dependence. Great pain and tension, which usually accompany these wounds, must be relieved by leeches to the abdomen, if they can be procured, (their application to the anus, so as to unload the hæmorrhoidal vessels, is much practised on the continent, in Russia especially, and is often attended with remarkable relief,) by the topical application of fomentations, and the warm bath; and if any internal medicine is given as a purgative, it must, for obvious reasons, be of the mildest nature. The removal of the ingesta, as a source of irritation, is best effected by frequently repeated oleaginous clysters; indeed, on the first infliction of a wound of the abdomen, the contents of the intestinal canal and stomach are generally evacuated spontaneously by vomiting, and soon followed by stools, which are sometimes tinged with blood; their accumulation must be guarded against by a rigorous diet; for to the general state of fulness of the vessels induced by food, is added its local and mechanical stimulus in the undigested form." (pp. 401, 402.)]

516. *Penetrating wounds of the belly* may be connected, 1, *with protrusion of the intestines*; 2, *with injury of the bowels*; 3, *with effusion into the cavity of the belly.*

517. In every penetrating wound of the belly, although its extent be but small, the caul or the intestines protrude. The protruding part either lies loosely in the wound, or is firmly grasped by it; and it is found either in its natural condition, or highly inflamed, and even mortified. It must be returned as quickly as possible into the cavity of the belly, and its further protrusion prevented. The patient should be placed in such position as will relax the abdominal muscles, and the intestines, by their own weight, will be kept from the wound. If the protruded parts be soiled, they must be washed with lukewarm water, and pushed by the two fore fingers, moistened with warm water, according to the direction of the wound, back into the belly, the patient at the same time making a long expiration. That part of the intestine last protruded must be first returned, the mesentery before the intestine, and the latter before the caul. The returned part must also be kept back with one finger whilst another portion is pushed in with the other. After the reduction, the fore finger must be introduced into the cavity of the belly, to be sure that the intestine have not passed into the interspaces of the muscles. The wound of the wall of the belly is to be treated according to the previous rules; the patient put in such posture as that the intestines should least press against the wound, and inflammation should be prevented by strict antiphlogistic treatment.

518. Should it not be possible to return the intestine in the way directed, because it is filled with air and fæces, or is protruded in very large quantity, and girt by the wound, it must be diminished by gentle compression, a portion of it drawn out of the belly, and then returned. If this do not succeed, the wound must be enlarged, just so much as needful to make the reduction possible. This enlargement is most conveniently made at the upper angle of the wound, because it is more free and because the intestines are not so easily again protruded if the wound be enlarged upwards as when downwards. Only when the upper angle corresponds to the white line, or to the suspending ligament of the liver, must the lower angle be preferred for enlargement. The wound should be enlarged in the following manner: the bowel is to be pressed aside with the left hand, whilst with the right a blunt director is introduced between the bowel and the edge of the wound, into the cavity of the belly, and held with the fore finger and thumb of the left hand, with its handle depressed. The intestine is next to be slightly raised, for the purpose of

seeing that there is nothing between the director and the wall of the belly, then drawn down with the other fingers of the same hand, and a blunt-ended bistoury introduced with the right hand on the groove of the director, and forming an acute angle with it, as deep as the enlargement of the wound requires; after which the director and bistoury are to be withdrawn together. The return of the protruded parts is to be effected according to the previous rules. If the girthing be so tight that no director can be introduced, the intestine must be pressed down with the left hand, by which the upper angle is freed, and the fore finger of the left hand, with its nail upwards, is to be directed into it, upon which first the skin, and then the muscles and aponeurosis are to be cautiously divided; and having come to the *peritoneum*, a director may be introduced, upon which it also may be divided: the intestine may, however, often be returned without doing the latter.

519. If the protruded intestine be highly inflamed, and bluish red, but if its gloss and firmness are not yet lost, it must be returned as quickly as possible, because only thereby, and with a simultaneous antiphlogistic treatment, can the passage to mortification be prevented. But if the intestine be actually mortified, it must be treated as will be mentioned in treating of mortified ruptures.

520. When the protruded caul is healthy, and the wound sufficiently large, it must also be returned with the moistened fore fingers of both hands into the cavity of the belly, after having first been washed with lukewarm water, if fouled with sand and the like. If inflammation have already commenced in the caul, it must not be returned. If the caul be tightly grasped, the wound must be enlarged, and the replacement effected as already described. But if the protruded caul be much bruised, and partially disorganized, suppuration would take place after its return, and we should have to dread dangerous inflammation of the *peritoneum* from the presence of a portion of the caul so much altered. It should therefore be left out, and covered with a compress steeped in a decoction of marshmallows. The same practice is to be pursued when the caul is gangrenous; the advice given in this case, to spread out the caul, to cut off the mortified parts with scissors, and to tie the vessels before returning it, is in most cases useless, because already has the protrusion formed adhesions about its whole circumference. If a small piece of the caul protrude through a narrow opening at the upper part of the belly, and the reduction be impossible without enlarging the wound it may also be left to nature; it unites with the edges of the wound, is covered with granulations, and prevents a rupture, is thrown off, or gradually recedes into the belly (*a*). But if the protruded caul be of large size it must always be returned, because it may contain part of an intestine, or its fastening in such an unnatural position may cause painful symptoms of tightness at the stomach (*b*). Ligature of the caul is questionable. When the caul protrudes with intestine, and the enlargement of the wound is necessary, this must always be done at the lower end of the wound, although the director be used.

Dupuytren (*c*) held most advisable the practice of leaving the caul protruding, because thereby its bruising and tearing is prevented, which, in a small wound, cannot be otherwise; and he did not enlarge the wound, which always increases the danger of rupture. All other modes of practice, as being accompanied with great detriment, should

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(*a*) Larrey, Mémoires de Chirurgie Militaire, vol. iii. p. 439.

(*b*) Sabatier, Médecine Opératoire, Nouv. Edit. par Sanson et Begin, Paris, 1822, vol. ii. p. 140.

(*c*) Ib. p. 138.

be rejected. The cutting off the caul produces much bleeding; its reduction brings a half-mortified structure in contact with a healthy one, which often produces severe inflammation; the ligature of the whole, in most cases, reproduces the symptoms of constriction. If the wound, through which the caul has protruded, be very narrow, it happens, though very rarely, that, from the swelling of its edges and of the caul, symptoms of constriction appear. If these symptoms be not relieved, as they almost always are by blood-letting, diet, bathing, softening fomentations, leeches, or, lastly, by enlarging the wound, when they run on to death, suppuration of the caul to a great extent and abscesses at different parts, and more or less firm adhesions with the corresponding surface of the *peritoneum* are found. Inflammation of the caul is, however, much more frequent after it has been tied and retained, than after the above practice, in which a strict antiphlogistic treatment, and an enlarging of the wound at the time, is nearly always sufficient to relieve the symptoms.

521. All the intestines of the belly may be injured by penetrating wounds; the danger of the wound is then greater and in the intestine so much the more as it is nearer the *pylorus*. The symptoms to be feared are *effusion of fæces, blood, bile, and the like, and violent inflammation.*

522. The peculiar symptoms of *Wounds of the intestinal canal* are, the patient vomits blood or passes it with his stools (1); stinking air and feculent matter escape from the wound; if the wounded gut protrude through the opening, it is found collapsed, and the wound in it may be seen (2). If the wounded gut be in the belly, these symptoms often first appear subsequently, and the injury of the intestine can then only be presumed from the depth to which the wounding instrument has penetrated and from the existing symptoms, the great anxiety, and so on, (*par.* 509,) the tension and painfulness of the belly.

[(1) Vomiting of blood, or passing blood by stool, does not always follow a wounded intestine; nor is extravasation of its contents into the peritoneal cavity a necessary consequence, although the wound may not be small.

Case 1.—A sailor was admitted into St. Thomas's Hospital many years ago, having been stabbed in the left hypochondrion by a bayonet, which "entering the *jejunum* at its commencement on the left side of the spine, traversed the *duodenum* and perforated it at its second turn." He vomited incessantly, and towards the evening of his death he threw up feculent matter, but never any blood, nor did he pass any by stool. He lived about thirty hours. There was not any feculent effusion in the cavity of the *peritoneum*, and the wound in the intestine was so small that it had been nearly overlooked. (pp. 19, 20.) This case is related by Travers (*a*).

Case 2.—W. H., aged fifteen years, was admitted under my friend Green's care,

Oct. 31, 1827. Having fallen some height on his belly upon an iron bar, he had severe pain and tenderness all over the belly, but specially at the pit of the stomach; great difficulty of breathing; pale anxious countenance; cold sweats, and constant vomiting of green, thin, watery fluid. In the course of the same evening he had a small motion, but no blood either in it or in the vomit. He died in about thirty hours. A wound an inch in length was found in the *jejunum*. The whole peritoneal cavity was highly inflamed, and containing a large quantity of serous effusion, but neither blood nor stool.

Case 3.—M. C., aged twenty-eight years, was admitted under my late colleague Tyrrell,

July 27, 1829. Shortly after eating his dinner was crushed between a waggon and a post. He had great tenderness of the belly, difficulty of breathing, and cold sweat. He vomited continually, but not any blood, and no relief was obtained from his bowels. He died in about fourteen hours. The *jejunum* was ruptured, and the edges of the wound everted and ragged. The *peritoneum* was inflamed, and its cavity contained some bloody serum, but no feculent matter.

Case 4.—J. L., aged eighteen years, was admitted on the evening of

July 16, 1829. Having been struck by some part of the machinery of a working steam-engine, which tore a wound in his belly from a little below the navel to the outer side of the thigh, extending over the hip-bone. Through this wound nearly all the small intestines and the sigmoid flexure of the colon were protruded, the latter having in it a wound of half an inch in length. Being in attendance for my friend Green, I tied the

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(*a*) Cited at the head of the article.

wound in the colon with a single silk thread, returned the intestines, and brought the edges of the wound in the walls of the belly together with the quill suture. He was covered with cold sweat, and had great pain in the belly, but had little anxiety of countenance. Fourteen hours after he began to vomit greenish matter, but no blood; his breathing became laborious. He did not pass any stool, and died in thirty hours, during the last hour and a-half of which he was comatose. The *peritoneum* was inflamed, and serum effused in its cavity; no adhesion in the wound of the colon, which was lying on the *m. iliacus*, but a portion of that intestine was firmly adherent to the muscles.

(2) As regards " wounds in which the intestinal tube directly communicates with the surface, and the alimentary or fecal matter is discharged by the parietes," TRAVERS states that " the principal feature by which they are distinguished from those unattended with feculent discharge or prolapse, namely the discharge of the intestinal matters, results from the size and apposition of the openings in the parietes and the gut. The symptoms are generally less imminent than of those in which the external communication does not exist, chiefly because the evacuation which takes place at the wound is a direct and powerful check upon the disposition to membranous inflammation which supervenes. The event of effusion being provided for, and the peritoneal inflammation rendered less probable or less formidable in its occurrence, the eventual importance of the case appears to turn upon the restitution of the intestinal functions." (p. 136-38.)]

523. A wound of the intestine may be a *stab*, a *longitudinal* or *transverse wound*, in which last the intestine may be either *simply cut into* or *completely cut through*. In slight stabs of the intestine the opening of the wound is always closed by the protrusion of the inner coat. In longitudinal wounds the edge of the wound always turns out, and from the contraction of the longitudinal and transverse fibres of the gut the wound assumes an oblong form. In transverse wounds the edges are not so widely separated, but they are more thickly turned out. In a transverse cutting through of the intestine the ends retract, and expand.

[Wounds of the bowels, like those of other parts, are of various kinds, and exhibit, as TRAVERS observes, " certain appearances depending upon the action of the bowel. If a gut be punctured, the elasticity of the *peritoneum* and the contraction of the muscular fibres open the wound, and the villous or mucous coat forms a sort of hernial protrusion, and obliterates the aperture. If an incised wound be made, the edges are drawn asunder and reverted, so that the mucous coat is elevated in the form of a fleshy lip. If the section be transverse, the lip is broad and bulbous, and acquires tumefaction and redness from the contraction of the circular fibres behind it, which produces, relatively to the everted portion, the appearance of a cervix. (' These appearances,' TRAVERS remarks, ' have also been described by HALLER (*a*).') If the incision is according to the length of the cylinder, the lip is narrow and the contraction of the adjacent longitudinal, resisting that of the circular fibres, giving the orifice an oval form. This eversion and contraction is produced by that series of motions which constitutes the peristaltic action of the intestines." (pp. 85, 86.)]

524. The opinions regarding the treatment of *an intestine wounded and at the same time protruded* are very different. Various kinds of stitches are proposed for the union of the intestine in longitudinal and partially transverse wounds; the *glover's stitch* (*b*), the *loop-stitch* (*c*), the *darning stitch* (*d*); in transverse wounds, through the whole thickness of the bowel, the *stitch of the four masters* (*e*), in which both ends of the intestine are fastened on a piece of windpipe of some animal, or on a cylinder of cardboard oiled; the *stitch* (RAMDOHR'S) *with ensheathing of the upper into the lower part of the intestine* (*f*), and the *interrupted stitch of which the threads are cut off near the knot*, and the knots are discharged with the stools (*g*). The stitch is employed by many with the view of

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(*a*) Elementa Physiologiæ, lib. xxiv. sect. 2, " Revolutio," and Opera Minora, vol. i. sect xv.

(*b*) HEISTER, Institutiones Chirurgicæ, plate iv. fig. 26.

(*c*) LE DRAN, Traité des Opérations. Paris, 1742, p. 80.

(*d*) GARENGEOT, Traité des Opérations. Paris, 1708, vol i. p. 188.

(*e*) LOUIS; in the Mémoires de l'Académie de Chirurgie, vol. iii. p. 192.

(*f*) MŒBII, Dissert. Obs. Misc. Helmst., 1780.

(*g*) JOHN BELL and TRAVERS.

preventing the escape of the contents of the bowel (and, therefore, many stitches are always used); but by others rather for the purpose of retaining the wounded intestine in a position corresponding to the external wound, and for effecting its union with the *peritoneum*. Some object to every kind of stitch, and only pass a loop through the mesentery, which SCARPA (*a*) also forbids.

LARREY carefully unites wounds with the glover's stitch, folds them in opposite directions, and brings them together with two threads of different colours.

525. Of late it has been attempted, by various experiments on brutes, to lay down certain rules for the *treatment* of wounds of the intestines.

In complete division of the intestine DENANS (*b*) introduces into the upper and lower end of the gut a silver or zinc ring, thrusting it inwards about two lines from each end; he then brings the two ends together over a third ring, of which the two springs retain the external rings. The included ends of the intestine mortify, and the rings thereby becoming unfastened are discharged by stool, after they have united the serous surfaces in contact. This experiment in the dog has most successful results.

BECLARD's practice on brutes, which he has also proposed for men, consists in slipping one end of the intestine within the other, after which he passes a ligature about the external portion of the intestine, near the edge of the wound, and ties it together. The ligature, by the approximation of the parts above and below it, covers at the same time the projecting upper and under pieces of the intestine, by which the serous membrane of both are brought into contact and so retained. The part tied by the ligature is, after a few days, cut through, the ligature falls into the hollow of the bowel and is passed by stool.

JOBERT (*c*), if the wound be above three lines long, employs the stitch, by which the edges of the wound are so brought together internally that the serous surfaces touch. In complete division of the intestine, after having ascertained which is the upper end, he takes hold of it with the left hand, and with the right thrusts a straight needle, armed with silk, from within outwards three lines distant from the mouth of the wound, and does also the same with a second thread upon the back of the intestine. He then thrusts the under end inwards, introduces the left fore finger, and upon it an assistant passes the needle from within outwards through the intestine. He then endeavours, by gently drawing, to bring the edges together, and to introduce the upper within the lower end. The piece of intestine is now retained, the threads drawn together and retained with sticking plaster. After five days the scar is perfected and the threads may be withdrawn.

LEMBERT (*d*) holds one lip of the wound, whilst he introduces the fore finger into the cavity of the gut, and with the thumb on the external surface presses and pierces it within two lines and a half from the bleeding edge, allowing the needle to pass about a line between the membranes of the intestine, and again passes it out a line and a half from the edge. After he has thus fastened on the external surface of the intestine a small piece of the serous and muscular coats, or even of the mucous coat, if the two former be not sufficiently resistant, he takes hold of the opposite edges of

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(*a*) Above cited, p. 279.—SCARPA, Sull' Ernie, translated by WISHART.

(*b*) Recueil de la Société Royale de Médecine de Marseille, 1 an, No. I. 1826.

(*c*) Mémoires sur les Plaies du Canal Intestinal. Paris, 1827.

(*d*) Répertoire Générale d'Anatomie et de Physiologie pathologique, vol. ii. Juin 3, 1826. FRORIEP's Chirurg. Kupfertaf, plate clxxi.

the wound, finds the point which corresponds to the part already pierced, and pushes in the same needle about a line and a half from the edge, allowing it to pass for a line's space between the coats and about two lines and a half from the bleeding edge. The other threads are applied in the same manner at a distance from three to four lines. The edges of the wound are then turned inwards by means of a probe, and a simple knot is made upon the probe, after which it is withdrawn. In consequence of this stitching, a ridge formed by the edges of the wound, projects into the intestine; externally a grove is seen, where the serous surfaces of the intestine lie close together. If the intestine be cut completely through, the edges of the wound produce an internal circular valve.

Reybard (*a*) recommends, in long and oblique wounds, the applicationof a flat thin piece of wood, having a double thread fastened to it, the ends of which are thrust with a needle through the corresponding edges of the wound of the intestine, and then both ends threaded together into a single curved needle, are drawn outwards at some distance from the edge of the wound, in the wall of the belly, through the latter, and here fastened on a roll of charpie, so tightly that the edges of the wound in the bowel, united on the piece of wood, are pressed to the inner surface of the *peritoneum*. The wound in the belly unites. On the third day the threads are loosened and withdrawn; the bit of wood is discharged by stool. In a complete cutting through of the intestine, the union of the gut with the *peritoneum* around the wound is effected either at first by a portion of the mesentery; or the gut is to be fastened to the bottom of the wound with some stitches, and then a pair of forceps having been applied on the opposed walls of the intestine, which form a projecting angle, they are cut into with the enterotome, and united by the continued application of the forceps during forty-eight hours, when the fæces take their natural course and the external wound closes.

[As Chelius, after enumerating so many modes of stitching up a wounded intestine, has given a decided preference to that recommended by Lembert, without noticing the practice of English Surgeons, except a very trivial reference to Astley Cooper's treatment of slight wounds in these organs, it is necessary to show what had been already proposed and done in this country long before.

Travers mentions the following experiment made by Shipton (*b*), an English surgeon, in the year 1702, and which is the groundwork of his own experiments. "Shipton having cut away a portion equal to two finger's breadth of the ileum of a dog, connected the extremities by an uninterrupted suture, and closed the external wound. The cicatrix being completed, and the parts examined at the end of three weeks, the result proved highly curious. The sewed intestine lay at a considerable distance from the wound, firmly attached to the *peritoneum*, but the suture had yielded, so as to allow the cut ends of the gut to recede, which were enveloped in a sac formed of adhering *omentum* and intestine. The following are the writer's words:—'Ad cicatricem ab internâ parte accuratius lustrandum, intestinum juxta longitudinem excidimus, quo ex uno latere vulneris labia adducta, ex altero eadem divisa proximisque adjacentium intestinorum partibus agglutinata fuisse apparebat, ita ut exteriores eorum tunicæ internum ab isto latere efformantes parietem, intestinalem fistulam continuarent, cibisque devehendis commode inservirent.' (p. 1301.) The appearances described and delineated by Shipton bear a pointed resemblance to those of experiment N. The divided parts were retained in the one case by suture, in the other by the continuous portion of the tube in opposition, though not in contact. In both, the interval of the orifices was a sac formed by the adherence of surrounding parts, which received the intestinal matters. In Shipton's experiment the artificial canal was more uniformly cylindrical, because the division was complete, in my own it was irregular, because the section was partial." (p. 114–16.)

(*a*) Mémoires sur le Traitement des Anus Artificiels, des Plaies des Intestins, et des Plaies pénétrantes de Poitrine. Paris, 1827.

(*b*) Observatio de portione intestini canis feliciter abscissa; in Phil. Trans. vol. xxii. p. i. 1703.

Else, in treating of Gastroraphy(a), by which he says, "I mean sutures of the intestines," recommends bringing the edges of the wounded gut together with the uninterrupted stitch; but it seems doubtful whether he had ever any opportunity of carrying out the practice he describes; for he says:—"If we consider when these sutures are to be applied, we should think there is seldom any opportunity to have them performed. In the first place it is never to be used unless the intestines protrude out of the wound of the abdomen. * * * If the intestine should protrude and it be wounded, what method are we to follow? Some authors very strongly recommend the interrupted suture; others likewise recommend the uninterrupted suture, but performed in a different manner, as, for example, the Surgeon is to hold one end of the intestine and the assistant the other; the needle (being a straight one) is to be stuck through both lips of the wound, and you must leave some inches of thread, which is to be tied to a bolster that is to be left on the outside of the abdomen. The needle is then to be stuck through again, observing always to do it on the same side, and, when finished, to leave three or four inches of thread to hang out of the wound, as before, and so as to be fastened to a bolster, &c. This then is an uninterrupted suture, but different from what was used in sewing up dead bodies. The threads are to be fastened to bolsters, that they may be afterwards withdrawn. * * * Few of these cases do well, as the fæces are generally discharged through the wound into the cavity of the abdomen. When the wound of the intestine is healed, you are to remove the suture; but how are we to know this? They say when the colicky pains have left the patient, and the fæces come the right way, you must first remove the suture of the abdomen, and then carefully draw the other away." Else refers to Le Dran's "looped suture," in which "three common straight needles, with common sewing thread, are passed through both sides of the intestine at equal distances; at the same time the assistant holding both sides of the intestine, the threads on each side are twisted close to the intestine, afterwards all of them are placed together, and the whole twisted again together, so as to bring the lips of the wound in contact; the thread is then to be left out of the wound, and fastened to a bolster. When the parts are united the threads are to be untwisted and so removed. This is a very ingenious method, but doth not answer so well as the former."

I have mentioned this plan of Else's to show, that although one part of the treatment, viz. that of sewing up the intestine completely, which we shall presently see is the proper practice, was effected, yet it was counteracted by bringing a mass of threads out of the wound, consequently keeping the cavity of the *peritoneum* open, instead of endeavouring to close it, and thereby necessarily to increase the already too great disposition of that membrane to inflame, and thus throw further obstacle in the way of the cure.

Benjamin Bell (b) objected to Le Dran's method of stitching, "that in some degree it must contract the diameter of the gut, by which dangerous obstructions might afterwards be produced. Instead of it the glover's suture, as it is termed, is commonly practised; laying the lips of the wound exactly together, and perforating both at the same time, a second stitch is now made by carrying the needle to the same side at which it first entered, at a small distance, perhaps at the eighth part of an inch, from the first, and in the same manner must continue by a proper number of stitches to draw the whole extent of the wound together. This being done, a sufficient length of the thread is to be left out at the external wound, for the purpose of drawing it away when we suppose the wound in the gut may be united. Even this method of treatment, however, must evidently tend to lessen the diameter of the gut, and I think the operation may be performed with the same degree of security, and in a manner that will obviate this difficulty, by entering the needle always from the inside of the gut and pushing it outwards. The operation should commence near to one end of the wound; the needle being pushed through one side of the gut, the ligature should be drawn forward and retained by a knot formed on the end remaining in the inside. The needle must now be carried straight across and entered in a similar manner, so as to pierce the opposite side of the wound also from within; but the following and every succeeding stitch will not be opposite to each other. * * * The end of the ligature may at last be secured and cut off close to the other extremity of the wound, if the gut is to be put freely back into the abdomen, or it may be left of a sufficient length to hang out at the wound. * * * This is indeed usually done, that we may have it in our power, as it is said, to draw away the ligature on the wound of the gut being cured. It is probable, however, whatever suture may be employed, if more than one or two stitches have been passed, that it will be very difficult and even uncertain, our getting the ligature away without hurting the intestines more than we ought to do. I would never advise, therefore, with any view of this kind, that the ligature should be left out at the wound; less danger will arise from cutting it

(a) MS. Lectures on Surgery.

(b) System of Surgery. 3d Edit. 1787. vol. v.

entirely away and allowing the stitches to remain; a considerable part of it will fall into the cavity of the gut." (pp. 277-81.)

John Bell (*a*) objects to the practice of sewing up the whole wound in the intestines, and directs "to make but one single stitch and sew the wounded intestine to the outward wound; there the gut will adhere, throw out its fæces for some time, and then heal, the outward and the inward wound uniting in one knot or scar." (p. 523.)

Travers's views in some important respects resemble those of Benjamin Bell. He says:—"Reflecting upon these results,(those from Shipton's experiments,) and unacquainted with the precise nature of the union by suture, I was induced to believe that simple apposition by the least possible interference, would suffice for the purpose of restoration. To determine which point, I divided the small intestine of a dog which had been for some hours fasting, and carried a fine stitch through the everted edges, at the point opposite to their connexion with the mesentery. The gut was then allowed to slip back and the wound was closed. The animal survived only a few hours. On *examination* the *peritoneum* appeared highly inflamed. Adhesions were formed among the neighbouring folds, and lymph was deposited in masses upon the sides of the wounded gut. This presented two circular orifices. Among the *viscera* were found a quantity of bilious fluid and some extraneous substances, and a worm was depending from one of the apertures. By the artificial connexion of the edges in a single point of their circumference, and their natural connexion at the mesentery, they could recede only in the intervals, and here they had receded to the utmost. The suture prevented the contraction of the circular fibres from the obliquity produced by the more powerful action of the longitudinal between the two fixed points. All circumstances therefore combined to facilitate effusion, the obvious cause of the quickly destructive inflammation." In another experiment, "I increased," says Travers, "the number of points of contact by placing three stitches upon a divided intestine, cutting away the threads and returning the gut. The animal refused food, and died on the afternoon of the second day. On *examination*, similar marks of inflammation presented themselves. The *omentum* was partially wrapped about the wound, but one of the spaces between the suture was uncovered, and from this the intestinal fluids had escaped. On cautiously raising the adhering *omentum*, the remaining stitches came in view. Here again the retraction was considerable and the intervening elliptical aperture proportionally large. On the side next the *peritoneum*, however, the edges were in contact and adhered, so as to unite the sections at an angle. From these experiments it appeared that apposition at a point or points is, as respects effusion, more disadvantageous than no apposition at all; for it admits of retraction and prevents contraction, so that each stitch becomes the extremity of an aperture, the area of which is determined by the distance of the stitches." (p. 116-19.)

Hennen says that he has only had two cases of wounds of the intestine, one with a shoemaker's knife and the other with a sabre, and he "practised the mode by a single stitch to the abdominal parietes and then closed the wound; * * * cutting off both ends of the ligature, and a perfect cure was effected in a few days in both cases." (p. 412.)]

526. In considering these various modes of treating wounds of the intestines, the objections made against stitching the intestines in general first present themselves. If every stitching of an intestine be considered as exceedingly dangerous, so much the more so must it be when, as commonly, the gut becomes inflamed by the injury or by the admission of air. Stitches through the several coats of the intestines, the threads still being retained, always produce a dangerous degree of inflammation. Numerous cases, in which, after the application of stitches on the intestine, the patient has soon died under very severe symptoms, prove this; and if some, after the employment of the stitch, have recovered, the reason is, that the stitches have torn out and the threads been discharged with the stools (*b*). The union of the wound of the intestine never produces an immediate connexion of its edges; as the continuity of the canal of the intestine after wound is reproduced merely by the adhesion of the wounded intestine with the peritoneum, or the surface of the neighbouring intestine. The stitch, also, cannot always be effectual on account of the escape of the fæcal matter, as the edges of the wound can never be kept in complete contact, but are

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(*a*) Principles of Surgery, New Edit. 1826. vol. i.

(*b*) Scarpa, above cited.—Travers, above cited.

always more or less separated by the retraction of the longitudinal fibres of the bowel, especially when the stitches begin to ulcerate.

527. To these objections it may be replied, that the assertion, that when stitching is employed on wounds of the intestine its result is almost always fatal, is proved by frequent experience to be unfounded (*a*). It must also be admitted, as an advantage of the stitching of the wound of the intestine, that though no immediate connexion of the edges of the wound be produced, still great separation is prevented by its adhesion with the *peritoneum* whereby the duration of the cure is shortened, the possible danger of stoppage of the passage of the contents of the bowels from adhesion of the angle of the intestine, and also the danger of artificial anus is prevented. The earlier generally accepted opinion that wounds of the intestine do not always unite by the immediate connexion of their edges, is denied by LARREY (*b*), who, resting on his own observation, asserts, that the union of a divided intestine, as in other parts, is effected by the projection of the opposed vessels, and so much the more quickly the closer the edges are united and kept in contact. The intestine, indeed, unites with the surrounding parts; but these adhesions are merely temporary, nature subsequently divides them by degrees, in order to restore to the intestine its peristaltic action.

[" The grand objections to the practice of returning a wounded bowel without a suture are," says TRAVERS, " the heavy drain upon the system if, as is probable, the evacuation be alimentary; the irritation occasioned by the continual discharge, and the tardiness of the healing process; the danger of future impediment to the free course of the matters from a permanent angularity of the adhering fold, or the encroachment of the parietes upon the tube in healing; and lastly, of future prolapse and even artificial anus, from the actual deficiency of the *paries intestinalis*, corresponding to the extent of the cicatrix. The objections now stated do not lie against the suture. The matters, with but slight interruption, such as often occurs from other causes, take their accustomed route; the nourishment of the patient is not withdrawn; the wound is reduced to a simple muscular wound and may be united, in part at least, by the first intention. The intestine being truly and directly reduced, recovers position and function; its cylinder is perfect of itself, and not formed by the walls of the abdomen." (pp. 185, 86.)

" It is not the kind of suture employed," TRAVERS further remarks, " but the application of it conformably to the principles of its operation, which is the object of real importance. The leading objection raised against the glover's suture is the difficulty of withdrawing it without injury to the recent adhesions; and the attempt at improvement upon it uniformly consists in the removal of this difficulty. It was upon the close connexion of the injured gut with the parietes exclusively that the union was supposed to depend, and it was not hinted before the time of Mr. BENJAMIN BELL that the suture would be discharged into the gut." (pp. 180, 181). The following are BELL's observations (*c*) referred to:—" It is probable, however, whatever suture may be employed, if more than one or two have been passed, that it will be difficult, or even impossible, to get the ligature away without hurting the intestine. I would never advise, therefore, with a view to this, that the ligature should be left out at the wound; less danger will arise from cutting it entirely away, and allowing the stitches to remain. *A considerable part of it will fall into the cavity of the gut.*"

The following are TRAVERS's directions for the stitching a wounded intestine:—" Let a small round sewing needle (triangular needles are certainly very ill fitted for the occasion) armed with a silk thread, be passed near to the lines formed at the bases of the everted lips. The thread is to be carried at short regular distances through the whole extent of the wound, the operator being mindful that an equal portion of the edges is included in each stitch. When the suture is finished, let the thread be securely fastened, and cut close to the knot. The reduction of the prolapsed folds should then be

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(*a*) Journal de Médecine, vol. xxvi. xliii. lx. Philosophical Transactions, 1722–1758. LOMBARD, Clinique des Plaies récentes où la Suture est utile. Strasbourg, 1800. Sect. x. Dictionnaire des Sciences Médicales, vol. xliii. p. 48. LARREY, Observations sur une Plaie du Bas Ventre, avec lésions d'un intestin grêle; précedée de quelques réflexions sur des plaies des intestins en général; in Revue Médicale, 1820, livr. lv. p. 77. Recueil de Mémoires de Chirurgie, Paris, 1821, p. 247.

(*b*) Ib., above cited.

(*c*) Surgery, ch. 3. sect. xii.

conducted with the nicest caution; and when completed, the wound of the teguments should be treated with a stitch, a plaster, or a poultice, as circumstances dictate." (p. 188.)]

528. In deciding on the several kinds of stitches, the most objections have been made to that recommended by **Ramdohr**, in which, if the intestine be completely divided, it is extremely difficult or impossible to distinguish the upper from the lower end of the intestine, and to introduce it properly, as it is much retracted within itself, and the ends of the intestine raised into each other are not in that relation which favours their union. Thus the external coat is in contact with the internal, consequently a serous is applied to a mucous membrane, which, under inflammation, always pours forth a large quantity of mucus, thereby preventing the union. **Denans** and **Jobert** have indeed by their practice set aside this circumstance; but similar difficulties remain with both of them as well as with **Ramdohr**'s plan; the mesentery must be separated and thereby the vessels going to the intestine are injured; there remains the difficulty of distinguishing the upper from the lower end of the intestine, and its insertion is still more difficult because the arc of the lower end is diminished by its own thrusting in. **Lembert**'s practice is entirely free from these objections; it may be employed equally in longitudinal wounds, and in complete division of the intestine; and is distinguished from **Reybard**'s mode of proceeding by its simplicity.

529. In all cases in which the wound of the gut is not so small that it is closed by its protruding internal membrane, the wound may have a longitudinal, oblique, or transverse direction. stitching, after **Lembert**'s plan, may be then considered as the most suitable practice. In small wounds, **Astley Cooper**, having lifted up the wounded part with a pair of forceps, applied around it a fine silk thread, and cut off its ends close to the knot. The ligature was discharged by stool.

Dupuytren (*a*) has simplified **Lembert**'s mode of stitching. The edges of the wound are to be thrust inwards, and the peritoneal surfaces brought into contact; a threaded needle is then to be passed through the back of each fold from the one to the other, so that each time the thread is brought back again over the lips of the wound, as in the glover's stitch, but is always introduced from the same side. The first edge is therefore always pierced from without inwards, the second from within outwards; and so it is recommenced with the former. By this stitching, the edges of the wound are brought together not merely by the stitches, but also by the pressure of the thread repeatedly drawn back obliquely or spirally. The united gut is then returned into the cavity of the belly; the ends of the thread fixed externally are to be cut off at the time of the actual union of the wound, and the threads withdrawn.

In complete division of the intestine, the same treatment, that is, the turning in the edges of the wound and the use of the glover's stitch, is more simple and efficient. The fore-finger of the left hand is to be introduced into one piece of the intestine, held between it and the thumb, and the wall of the gut penetrated as near as possible to the mesentery, at a line and a-half from the edge; a piece of thread, four or five inches long, is to be held by an assistant; herewith the opposite portion of the intestine is held, and perforated in the same way, and again brought back to the former piece, till the mesentery is again reached, when the stitching is perfected; the threads are then to be somewhat drawn, the edges of the wound laid straight with the forceps, the intestine returned into the belly, both ends of the threads to be fastened externally, left for five or six days on the surface, and then cut off to be removed. If it be thought dangerous to draw out the encircling threads, a thread may be introduced among them, at the free edge of the intestine, into one of the spiral loops, and with this, after cutting through both ends of the suture thread, it may be drawn out. Both ends may also be cut off, and the spiral thread left, which then falls into the intestine and is discharged by stool. This stitch is easily taken out, requires no special operation, and is so firm that the air cannot escape through the wound.

(*a*) Above cited.

According to JOBERT (*a*), the application of the stitching, with turning in of the edges of the wound but drawing together of the threads. The inflamed serous membrane bears this, but it tears in knitting together.

[TRAVERS gives the following excellent description "of the reparation by artificial connexion of the divided parts" of a wounded intestine. "It commences with the agglutination of the contiguous mucous surfaces, probably by the exudation of a fluid similar to that which glues together the sides of a recent flesh wound when supported in contact. The adhesive inflammation supervenes and binds down the reverted edges of the peritoneal coat, from the whole circumference of which a layer of coagulable lymph is effused, so as to envelope the wounded bowel. The action of the longitudinal fibres being opposed to the artificial connexion, the sections mutually recede as the sutures loosen by the process of ulcerative absorption. During this time the lymph deposited becomes organized, by which further retraction is prevented, and the original cylinder with the threads attached to it are encompassed by the new tunic. The gut ulcerates at the points of the ligatures, and these fall into its canal. The fissures left by the ligatures are gradually healed up; but the opposed villous surfaces, so far as my observation goes, neither adhere nor become consolidated by granulation, so that the interstice marking the division internally is probably never obliterated. An intestine treated by suture is always more or less connected by incidental adhesions to the contiguous surfaces; these may, with some caution be detached from the peritoneal coat. Irregularities of the external surface, from exuberances of deposition, seem to depend upon the partial or irregular apposition of the cut extremities; and the width of the interstice is determined by the more or less firm and complete contact in which the divided parts are held by the suture. Although the substance of the *paries intestinalis* is ever after deficient in the line of division, yet, by inspection of the external surface, it would be difficult, if possible, to say, where the division had taken place, even at a recent period from the injury." * * * "It has been found sufficient for the purpose of union to include only the the peritoneal covering of the intestine in the suture, a proof that provided the severed extremities are firmly brought into contact, the event under any circumstances, will be uniform. The adhesion which takes place between the mucous surfaces, in a few hours after their connexion by suture, is in no instance permanent, being destroyed by the retraction of the divided parts when the ligatures loosen. But if this retraction could be prevented, and the mucous surfaces were retained in contact, it is probable that no organized, and of course no permanent union could take place betwixt them; for the internal coat of the bowel is, as before observed, indisposed to the adhesive inflammation. For this reason it is, that the ligatures invariably pass into the canal; their separation externally would have interrupted the healing process, as we find to be the case in other parts to which they are applied." (p. 128–32.)]

530. If, in a perfectly divided intestine, only one end project through the wound, and the other be not to be found, a single loop is to be drawn through the mesentery, brought back, and attached to a corresponding part of the external wound.

531. If there be supposed to be a wound of an intestine, or if it be certainly ascertained, (*par.* 520,) nothing more can be done than to bind up the superficial wound, and obviate dangerous inflammation by strictly antiphlogistic treatment. Repeated general and local blood-lettings must be had recourse to, which the seemingly great weakness of the patient, the small compressed pulse, the cold extremities, should not preclude. Softening poultices are to be applied over the belly, and it should be attempted to overcome the great disposition to costiveness which exists in every wound of the intestine, by mild purgatives with oily emulsions, but still more certainly with repeated clysters, and with calomel. The patient should be kept as quiet as possible, and lie upon the injured side.

If the fæcal matter escape from the wound, it must be kept open; and, as often as cleanliness requires, it must be dressed. At every dressing it must be attempted, by a slight pressure on the region of the wound, to facilitate the escape of the fæcal matter. The prescribed general treatment

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(*a*) Archives Générales de Médecine, 1837, March.

applies, as self-indicated, to those cases in which the wounded intestines are retained together either with or without suture.

This is the only treatment which, in shot-wounds, can be really employed; because in such cases the intestines rarely protrude, and the extraction of foreign bodies is impossible.

[In the treatment of wounds of the intestines without feculent discharge or prolapse **Travers** says:—"The remedies upon which I feel disposed to rely are few and simple. Total abstinence from solid food and a drink easy of absorption given in very sparing quantities and at long intervals, with a rigid preservation of the supine posture, are restrictions which should be rigorously observed so long as any are indicated. * * * Injections, as **Paré** has well observed, should be administered, if at all, with great caution. One full bleeding might be advisable before the commencement of symptoms. To any more active treatment I should take the state of the stomach as my guide. The intimate connexion and lively sympathy subsisting between the digestive and the vascular systems render the pulse an equivocal if not fallacious criterion of the morbid changes which are to ensue. But if the stomach is quiet, we have little to fear; if it can be tranquillized, mischief may be averted; it is not in a state to retain medicine, if medicine could be exhibited with a prospect of obtaining the end; but to this it is manifestly inadequate under the circumstances of the case. How then shall the irritation of this organ be appeased which, if it continues, is a never failing omen of destruction?—I would answer by the reduction of the system. Early, free, and repeated blood-letting, general and topical, is the main remedy upon which I place reliance. Nor while the stomach retained its irritability and the pain continued undiminished, would I be deterred from it by the variations of the pulse. The apprehension of reducing the power of the system below the means of reparation is futile. Under such a state of active inflammation in such parts, the patient cannot long exist; nor if he could, would this state admit of the repair of an injury." (p. 74-7.)

I do not think the sole reliance on bleeding here recommended by **Travers** is sufficient in the conduct of these cases, in which the peritoneal inflammation always sets in very speedily; neither do I think it expedient to carry it to such extent as he advises, for I am sure that cases would occur in which almost the last drop of blood might be withdrawn, and yet the inflammation continue. I think it is therefore preferable to treat these cases as peritoneal inflammation after operation for strangulated rupture are treated, that is, by more moderate bleeding, and by the use of mercury till the constitution is affected, either by calomel, or by rubbing in mercurial ointment; and of these the latter is to be preferred, because although the stomach will commonly retain the calomel, yet it will often run off by the bowels, which it is far less likely to do, if rubbed in.—J. F. S.

"The process of spontaneous reparation," **Travers** observes, "depends upon the indefinite extension of the *peritoneum*, (by which membranous surfaces, identical in their organization and properties, are everywhere opposed,) and upon its disposition to assume the adhesive inflammation. Thus, if a bowel be wounded lying in contact with the *peritoneum* of the muscles, it repairs itself by the mutual adhesion of the cut surfaces; another, more distant from the parietes contracts a close adhesion with the contiguous fold, or lays hold of the adjacent *omentum*. If the wound is an orifice from loss of substance, it is never obliterated by the deposition of new matter, but by the permanent close adhesion of the surface applied to its margin; if on the contrary it is simply a division of substance, as in a clean cut wound, the sides may unite *per se*, without contracting any surrounding adhesions." (pp. 58, 9.)]

532. Very commonly a contraction takes place at the part where the intestine is wounded, in consequence of which the fæcal matter is passed with difficulty, collects, and even may produce bursting of the intestine. Therefore, for a long time after the wound is perfectly healed, a proper dietetic regimen is to be pursued, and, especially, all overloading of the intestinal canal, and the use of coarse food, are to be avoided.

533. The most dangerous complications of penetrating wounds of the belly are, effusion of *fæcal matter*, *blood*, or other *fluid*. These extravasations do not happen so easily or so frequently as is supposed, on account of the mutual pressure which the intestines and the walls of the belly exert

upon each other, so that there is no space between them. These effusions therefore, when they occur, spread not always in every direction upon the surface of the intestines, but collect in one spot.

["Effusions of blood from large vessels," **Travers** remarks, generally "prove fatal by their volume suspending or interrupting the functions of life. * * * The complete effusion of bile, urine, or feculent matter, prove uniformly fatal, by their quality inducing a destructive inflammation. The symptoms of an effusion which oppresses the vital functions by its volume, or arrests them by inducing syncope, will be easily distinguished from those of an effusion which excites inflammation. The former indeed usually subside in death, before the latter are engendered. It would be difficult to determine the fact of fæcal effusion, perhaps in most cases impossible. * * * The train of symptoms characterizing a peritoneal inflammation, the result of local injury, differs in many respects from that which has been described as belonging to puerperal *peritonitis*. Indeed few symptoms of the disease, originating from the same cause, are not varied and modified in different subjects, so as to prevent us from regarding them as diagnostic. In some cases the belly is distended, in others soft ; in some it is acutely painful to the touch, in others it will bear a degree of pressure ; the pulse is often small and rapid, but I have known it moderately full and not much exceeding its natural frequency. Distressing nausea and vomiting, constipation, acute pain and restlessness are invariably present, and are perhaps the only symptoms which may be considered certain in their occurrence." (p. 71–74.)

"Sometimes the effusion of the contents of the intestine," says **Hennen**, "takes place very soon after the receipt of the wound ; in other cases, especially of gunshot, it does not appear until the eschars separate." (p. 406.)]

534. The *contents of the intestine* do not extravasate so readily as blood, because the resistance of the walls of the belly is greater than that which it has to overcome, in order to its being driven forward in the intestinal canal. The effusion of fæcal matter happens more easily in the small than in the large intestines, easier in torn than in cut wounds ; more easily in oblong than in transverse wounds, but more especially when the intestine is full, or the resistance of the walls of the belly is diminished by effusion of blood, or by the entrance of air into the cavity of the belly. In how far the changes which take place in the different wounds of intestines can render difficult the escape of the feculent matter, depends upon the causes already stated (*par.* 523.)

[**Travers** observes:—"It appears that effusion is not an ordinary consequence of penetrating wounds, that the same opposition to effusion exists after death as before it, and consequently that such opposition must depend on passive pressure, not on active resistance. If the gut be full and the wound extensive the surrounding pressure is overcome by the natural action of the bowel tending to the expulsion of the matters. But in defect of either of these states, effusion cannot follow. If the canal be empty at the time of the wound, no subsequent state of the bowel will cause effusion, nor can effusion take place from a bowel at the moment full, provided it retains a certain portion of its cylinder entire." (p. 25.) He further adds:—"When, however, air has escaped from the bowel, or blood has been extravasated in quantity within the abdomen at the time of the injury, the resistance opposed to effusion will be less effectual, although the parietal pressure is the same, as such fluids will yield more readily than the solids naturally in contact." (p. 26.)

"The impediment to effusion of intestinal matters consists," according to **Travers**, "first, in the resistance which the mechanism of the abdomen opposes, and secondly in the circumstances contingent upon and peculiar to intestinal wounds. By the former I mean the general contact and equal pressure before explained, (viz., if the chest or belly of a living animal could be inspected, whilst the boundaries remain entire, it would be found that the contents were in actual contact with the parietes; that an intestine, for example, was on every side in contact with the surrounding intestines, or with the *peritoneum* lining the muscles. Instead therefore of floating loosely, as has been represented, it is supported by the equable pressure of the parts in its vicinity (p. 9);) by the latter the processes of eversion, contraction, and peritoneal adhesion." (p. 132.)]

535. The symptoms produced by such effusion are, high fever, dryness of the tongue and throat, unquenchable thirst, distension and painfulness of the belly, convulsive twitchings, hiccough, vomiting, anxiety, and so on; the inflammation thereby excited passes quickly into gangrene. These symptoms generally come on the day after the accident.

536. *Effusion of blood into the cavity of the belly* takes place either from a wounded epigastric or internal mammary artery, if the state of the wound prevent the free external escape of the blood, or from the arteries and veins within the belly. Blood from the cavity of the belly often seems to be driven, by the pressure of its walls, through the wound into the intestine, at least there is often observed a decided discharge of blood from the rectum, which cannot arise from the vessels of the gut alone. The blood collects, according to the different size of the injury and of the vessel, in larger or smaller quantity, more quickly or more slowly. The symptoms of effusion of blood into the belly are, therefore, very different, and, in general, depend on the loss of blood, on the pressure of the blood upon the intestines, and the irritation thereby excited. The patient gradually becomes weaker and weaker; in proportion as the effusion increases, the belly swells at the lower and fore part, or upon one side or other, and fluctuation is felt. From the pressure of the blood on the urinary bladder there is frequent desire to make water, the countenance of the patient is pale, the pulse small, the limbs become cold, and frequent swoonings occur. If the bleeding cease, these symptoms disappear, but recur when it returns. If the blood be poured out slowly, or in small quantity, the symptoms are less marked.

537. The blood effused in the cavity of the belly collects either in a circumscribed space, between the surface of the intestines and the front wall of the belly, mostly in a single mass, on one side or other of the white line; or at different parts at the same time; or it is diffused and spread in all directions, and between the windings of the intestines. The causes of this variety of relations of the blood effused in the cavity of the belly depends partly on the quantity, on the origin, and quickness of the effusion (copious and quickly produced effusions and those from the veins are more diffused); partly on the changed relations of the tone of the intestines and walls of the belly, from other circumstances, as, for instance, the simultaneous escape of air into the cavity; partly on the violent movements of the patient, partly on the original seat of the inflammation. In diffused and extensive effusion, death ensues either from bleeding or from severe extensive inflammation. In circumscribed extravasation, plastic exudation occurs from inflammation around the mass of blood, by which it is cut off from the rest of the cavity of the belly. The fluid parts of the blood are absorbed; the solid parts may continue a long while, and at last disappear by absorption. If the extravasated mass be larger and not removed by absorption, it gradually softens in the middle, and becomes the seat of a fetid fermentation; the swelling formed by the extravasation becomes larger, and fluctuates; pain, tension, fever, vomiting, and so on, arise.

Upon the different opinions, in reference to the circumscription of blood effused in the cavity of the belly, (J. L. Petit, Bell, Fourcade,) and its extension, (Garengeot, Desoer,) compare also Jobert.

538. If extravasation appear after a wound has been received, the patient must be laid upon the injured side, and the wound kept open, a wad of half-torn linen being introduced into the lower angle of the wound so as to effect the escape of the blood. If extravasation occur after the

wound have closed, it must be again opened, and a broad belly-band applied for the purpose of pressing the extravasation towards the wound. If the bleeding continue, we have no direct means of stanching it; repeated blood-lettings must be employed, with the most complete state of quietude; cold fomentations must be laid on the belly, and a belly-band applied sufficiently tight. If the extravasation be near the wound, the finger or the probe must be carefully introduced, and the intestine somewhat thrust back; if swelling and fluctuation occur at any other part, or after the wound has closed; if the effused blood be not absorbed under proper treatment; if symptoms of decomposition, pain, tension, increase of the size of the swelling, fluctuation, and fever appear, in such cases the extravasation must be emptied, which is best done by a bistoury, with careful incisions dividing, layer by layer, the coverings to such extent that the collected fluid flows out readily; but we must not run the danger of disturbing the adhesions around the extravasation. The evacuation with the trocar, which can be employed only in very large swellings and distinct fluctuation, is always less satisfactory, and the presumed removal of the air thereby of less importance. The further treatment is simple; the wound is to be covered with charpie and a poultice, the free escape of the decomposed blood being carefully provided for, and assisted by gentle injections of lukewarm water. The general treatment must be proportionate with the circumstances. If the blood be extravasated into the whole cavity of the pelvis, it sinks into the pelvis, because the adhesions surrounding the extravasation are destroyed, and mortification and death soon ensue.

[538.* In wounds of the belly and intestines, the ball or other substance which has penetrated, is sometimes retained, and after a time passed by the natural passages.

The following remarkable instance of this kind is mentioned by Hennen :—

Case.—Serjeant P. M. received a ball in the belly on the evening of the 18th June, 1815, which struck him " upon the right side, about one inch below the navel, and three fingers' breadth to one side. Scarcely a tinge of blood followed the wound. He did not fall, but walked about fifty yards to the rear, from whence, in half an hour, he was carried to a large barn in the village, where he remained for three days before he was conveyed to an hospital at Brussels. During this period he was bled three times *ad deliquium*. The first vein was opened about twenty-four hours after the receipt of the wound. On his arrival at Brussels his principal complaint was incessant straining to stool, for which he received daily clysters. On the sixth day from the receipt of the wound, immediately after an enema, he had an urgent call to the close stool, when he passed a small-sized rifle musket-ball, enveloped in mucus, and unaltered in shape, except a small groove indented in it, probably from cutting along the bayonet or ramrod of the piece from which it was fired. The wound was perfectly healed on the *26th August* following, without any ill accident or uncommon occurrence from the time of receiving it, except that, during the course of the first night he was sensible of a sort of watery oozing that moistened the linen placed on his wound, particularly whenever he drank, which he frequently did. This circumstance he was never after sensible of. He joined his corps at Paris, but had not been more than ten weeks there, when severe pains again arose in the bowels; some bits of cloth were passed by stool, an abscess formed externally; and every symptom threatened approaching *peritonitis*, which was relieved by active means, under the charge of Staff-Surgeon Dease." In the following year he was seen: " his general health was good, but if he indulged in a full meal, he felt severe pain in the part. He was subject to obstinate costiveness; and if he allowed the bowels to remain for any length of time in that state, the pain produced in the abdominal region, and particularly in the wounded part, became very severe indeed. The motion of his limbs gave him no pain, although for some time after receiving the wound he was obliged to bend his body in walking, and he performed that movement with considerable uneasiness; but if he stooped or drew in his breath forcibly, he experienced very severe pain. In all other respects, his general health and appearance were in as good a state as before the receipt of the injury." (pp. 404, 405)]

A.—OF WOUNDS OF THE STOMACH.

539. The Stomach may be supposed to be injured from the depth and direction of the wound. The usual symptoms are vomiting, vomiting of blood, escape of the food, fixed pain in the region of the stomach, together with anxiety, depression, and the other symptoms accompanying penetrating wounds of the belly. These symptoms are not, however, always decisive. If the external wound be large, a part of the stomach may protrude through it.

540. Wounds of the Stomach are always very dangerous; as in other wounds of the intestinal canal, extravasation into the belly and inflammation are to be dreaded. The danger is greater if the stomach be wounded when full of food than if empty. Wounds in the middle of the stomach are less dangerous than those in its curvatures.

541. The *treatment* of wounds of the stomach generally agrees with that laid down for wounds of the intestines. If there be not vomiting after injury of a full stomach, according to some opinions, it should be emptied by an emetic, but others recommend this should not be done, for fear of increasing the wound and the extravasation in the belly. The patient must be treated on the most strict antiphlogistic plan; he must not feed by the mouth; his thirst must be alleviated with slices of lemon or Seville orange sprinkled with sugar; relief by stool must be promoted with softening clysters, and warm fomentations on the belly, if the sensibility permit. If severe spasmodic symptoms be present the simultaneous employment of opium in the clysters is indicated. If the food escape through the wound, it must be kept properly open, and the patient laid upon the wounded side. If the external wound be large, the wound of the stomach directly opposite, or the wounded part of the stomach protrude, a thread may be drawn through both edges of the wound of the stomach, and its ends allowed to hang out, in order therewith to bring the edges of the wound somewhat together, and to retain them properly to the wound in the walls of the belly, or the stitching may be employed according to the rules given for its use in wounds of the intestines (1). After forty-eight hours the loop may be withdrawn, because adhesion with the peritoneum has then taken place and extravasation into the belly is impossible. If a fistula remain the opening must be kept closed with a proper compressing apparatus (2).

[(1) The following is a brief account of SCOTT's case (*a*) of wounded stomach without protrusion, after which the patient recovered.

CASE 1.—C. T., aged twenty-five years, a seaman, was wounded *March* 31, 1784, by a small sword, which passed in between the second and third of the lower false ribs on the left side, and penetrated horizontally into the cavity of the belly to the extent of more than five inches. His countenance (half an hour afterwards when he was first seen) was collapsed, and covered with a cold sweat; pulse at the wrist scarcely perceptible; constant hiccough, frequent retching and vomiting of blood, and a considerable discharge of blood and other fluids from the wound. Barley water had been given to drink, as he was very thirsty, but was thrown up immediately after passing the *œsophagus*, and effervescing mixture with some laudanum had no better effect, being thrown up tinged with blood. The retching continuing very violent, and the patient complaining of a lump, or dead weight as he called it, in his inside, he was desired to

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(*a*) Medical Communications, vol ii. p. 78.

drink some warm water, which was soon thrown up with a good deal of barley in solid grains, and some pieces of half-digested meat. More water being given, was also returned tinged with blood. It was determined to give nothing more by the mouth, but an emollient clyster was thrown up, which brought away a considerable quantity of fæces. A second clyster was then injected, containing two drachms of laudanum, which was for the most part kept up. Warm fomentations were applied; the wound lightly dressed; and he was directed to lie as much as possible on the injured side, to favour the discharge. On the following day he was in much the same state; towards morning he had some rigors and very violent spasms; complained of cold over the whole body, and a constant gnawing about the pit of the stomach. A laxative clyster was injected, and produced a copious evacuation; after which a veal-broth clyster, with two drachms of laudanum, was thrown up twice in the day, and retained. Hot flannels dipped in milk and water were applied to his arms and legs, and hot bricks to his feet. He passed a little water twice.

April 2. Had passed a restless night, and complained of intense thirst, with a constant burning pain in the lower part of his stomach; hiccough and spasm less frequent; pulse 120, small. An injection of six drachms of Epsom salt with broth was thrown up, and brought away a considerable quantity of soft slimy fæces, containing small bits of clotted blood enveloped in mucus. Clysters of broth and laudanum were thrown up during the day, and retained; and he was allowed some orange pulp to allay his thirst, and barley water with lemon juice to wash his mouth.

April 3. Very early this morning, whilst supported in bed to wash his mouth, he accidentally swallowed some of the liquor, and was seized with violent retching accompanied with convulsions of the chest; but threw up nothing, except a small quantity of bloody fluid. He was covered with cold sweat, and the pulse low and intermitting. Warm fomentations were applied to the stomach, and veal broth with two drachms of laudanum thrown up, by which he was relieved. Injections of broth were given at intervals of six or eight hours.

On the following day the hiccough, retching, and other unfavourable symptoms, had ceased; but he still complained of fixed pain in the stomach, with a sensation of heat and soreness extending from the wound towards the middle of the belly; pulse 110, small; thirst. The external wound had began to discharge good matter.

The same plan of treatment was continued, but the clysters from four to five pints a day; fomentations, and bathing the hands and feet with milk and water. He passed about three pints of urine in the course of the day. Purging salts were occasionally added to the clysters, to stimulate and cleanse the bowels; but after the fourth day there was scarcely any feculent matter discharged, but only a small quantity of viscid bile.

On the tenth day after the injury he was very sensibly relieved; his thirst and febrile symptoms abated; pulse 90, and regular; and he was in good spirits. As he wished for some calf's-foot jelly, about half a pint, lukewarm, was given, which had no bad consequences; but the first time of swallowing was followed by frequent eructations and a great discharge of air, which he said produced rather a grateful sensation than otherwise. Next day he had milk for breakfast, and chicken broth for dinner. The nutritive clysters were continued till the sixteenth day, but less frequently; and for the next fortnight he lived wholly on bread and milk and light broth; after which he was allowed chicken, veal, and other meats easy of digestion. The external wound had healed for some time, and he recovered very gradually. The only inconvenience he suffered was from costiveness, which was relieved by gentle laxatives and stimulating clysters; and a sense of soreness and stricture which extended from the external wound towards the middle of the belly, and particularly felt after a violent expiration or any sudden extension of the body, when, to use his own expression, his side was drawn inwards and upwards. The latter SCOTT supposed to have originated from an adhesion of the inflamed stomach to the *peritoneum*. It went off gradually as he recovered strength, though still felt in a certain degree in stooping, walking quick, or any great exertion of the body.

In the following case TRAVERS (*a*) tied a ligature around the wound of a protruded stomach, and the patient recovered:—

CASE 2 —M. G., aged fifty-three years, was admitted into St. Thomas's Hospital

Oct. 18, 1819. Having attempted about noon to destroy herself, by wounding her belly with a razor. A large transverse wound divided the parietes to the extent of three inches, a little below the navel, in a line inclining obliquely downwards from left to

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(*a*) A Case of Wound with Protrusion of the Stomach; in Edinburgh Journal of Medical Science, vol. i. p. p. 81. 1836. Accompanying which are some very valuable observations on Wounds of the Stomach from various causes.

right. Through this the greater part of the large curvature of the stomach, the arch of the *colon*, and the entire large *omentum*, were protruded and strangulated. The *omentum* was detached from the stomach to a considerable extent; and two wounds appeared on the latter *viscus*, the one a peritoneal graze, and the other a perforation of its coats admitting the head of a large probe. From this opening a considerable quantity of mucus issued. When admitted *at half-past* 6, she was exceedingly faint and exhausted; pulse 102, and irregular; countenance pale and dejected; surface of the body moderately warm; little pain in the *abdomen;* diaphragm irritable, having a disposition to, rather than actual hiccough, but no vomiting. The space between the *omentum* and stomach was filled with *coagula*, but it did not appear that she had lost much blood. A small portion of the coats of the stomach, including the wound, was nipped up with a pair of forceps, a silk ligature tied around it, and after a vertical dilatation of the wound, the protruded *viscera* with considerable difficulty returned into the cavity of the *abdomen;* the parietal wound was closed by the quill suture; warm fomentations were applied to the abdomen; and the patient ordered to be kept strictly quiet, and without food or drink. During the reduction she suffered excruciating pain, and from the spasmodic action of the diaphragm considerable resistance was offered to their return, notwithstanding the entire relaxation of the abdominal muscles.

Oct. 19, 8 A.M. Has slept a good deal, and passed a tolerable night; has vomited twice, in consequence each time of tea having been given, contrary to orders. Feels comfortable and free from pain, and has little tension of the *abdomen;* but upon pressure there is considerable pain; no motion, but has voided much high-coloured urine; pulse 120, full and soft; skin warm; tongue white and moist; countenance less pallid and anxious. An injection of salt and gruel ordered. In the evening three drachms of castor oil were given, as there had not been any operation from the injection, which had caused great pain. She has vomited a little twice, though she has not taken any thing. Pulse rather contracted and hard Twenty leeches to the abdomen.

Oct. 20, 8 A. M. Has had a restless night, and vomited once, but has not had any hiccough. Pain and tension of the belly increased; skin hot and dry; pulse 106, hard; tongue dry, and rather brown; no stools; complains of much thirst. 2 P.M., a considerable exacerbation of the symptoms just mentioned, with violent headache and sickness. Eighteen ounces of blood from the arm. A drachm of sulphate of magnesia in effervescing saline mixture every hour. Twenty leeches to the belly. 10 P.M. much relieved from pain and fever; pulse reduced and less hard; blood a little buffy, but not cupped; retains the medicine, but it has not operated. She continued restless during the night, but became easier towards the following morning, and had two offensive dark-coloured motions. Pulse full and soft; considerable tension of the *abdomen.* Took a little bread and milk, at breakfast. During the day she had three stools, and continued improving during the following day, when she was ordered beef tea and gruel, and to take the salts in mint water.

Oct. 23. Was disturbed last night with spasms of the abdominal muscles, which were soon relieved by warm fomentations. The sutures were removed, and the wound appears united by adhesion, saving at its right extremity, where there is a small aperture, from which a serous fluid escapes in considerable quantity. Adhesive straps applied. Next day she felt so well that she thought she should recover. She is anxious for food; eats with appetite and without inconvenience. The action of the bowels regular; to take the salts only occasionally. Diet as before. Wound dressed, and looks healthy.

Oct. 25. Not quite so well. On removing the dressings, a considerable quantity of pus and serum escaped from the unhealed angle of the wound.

Oct. 29. Has continued improving, and has sat up twice. No serum flowing from the wound, which is nearly healed, and discharges a little healthy pus. She continued doing well till

Nov. 2, when she was suddenly attacked with rigors, and symptoms of peritoneal inflammation followed. Sixteen leeches to the abdomen, and a free evacuation of the bowels by castor oil, soon relieved her. A week after the wound had entirely healed, and four days subsequently she got up and left the house.

Dec. 23. Quite well. The ligature of the stomach was not observed in the evacuations.

(2) A very interesting case of recovery from a fistulous opening in the stomach is related by Dr. J. H. Cook (*a*), and is proper to be mentioned here, as proving the possibility of separation, although not arising from an inflicted wound, but probably from an

(*a*) Western Journal of Med. and Phys. Sciences, Jan. 1834; and in London Med. Gazette, vol. xiv. p. 541.

ulcer of the internal coat, as the patient stated that six months previous to her applying to COOKE she was attacked with constipation and violent pain at the pit of the stomach, which resisted every remedy, till the nineteenth day, when the fistula showed itself. The patient was thirty-nine years old. The fistulous opening was immediately by the side of the *umbilicus*, and into it a buck-shot might have been readily passed. On removing the bandage a small quantity of bile was suddenly discharged, after which a small quantity of a different (gastric?) fluid came slowly away. These discharges were attended with great pain, on account of their acrid quality. The whole surface of the abdomen was excoriated, inflamed, and intolerably painful. A flexible catheter, thirteen inches long, was introduced its whole length before meeting any resistance, when the extremity suddenly met with an obstacle, by pushing against which, or even by slightly agitating the instrument, strong efforts to vomit were produced. Withdrawing the catheter, we desired her to drink a glass of water. She did so, and in *twenty seconds the whole* was discharged through the fistula, as we ascertained by measuring it. The direction of the fistula was upward, and slightly inclining backwards, with about the same inclination to the right side. We came to the conclusion that the opening within was at or about the pyloric orifice of the stomach, and that the catheter entered the stomach and pressed against its cardial portion. The *treatment* consisted in covering the inflamed surface with basilicon, spread on fine linen, and covering the whole *abdomen* with adhesive plaster spread on ox bladder, in which a hole over the fistula was made for the escape of the discharge. A compress and bandage were applied over these, and directed to be reapplied after every discharge. Mucilaginous drinks, a diet of rye mash and molasses, and nourishing clysters were ordered, the patient being much emaciated for want of proper nourishment, every thing having passed off undigested through the fistula, and no evacuation had taken place in the natural way for ten days. The external irritation soon ceased, and the bladder was then applied to the skin for a protection with the happiest effect. The bandage was gradually tightened, and a cylindrical compress laid over the course of the fistulous canal. She slowly but steadily recovered. In a few days the alvine evacuations were restored to their natural outlet, and the discharges from the fistula began to decrease. In thirty days the opening was closed, and the fistula apparently obliterated. Several months have elapsed since that event, and she continues in excellent health.]

B.—OF WOUNDS OF THE LIVER.

542. Injury to the Liver may be presumed from the depth and direction of the wound. A large quantity of black blood flows out, frequently mixed with bile; the patient feels a deep pain in the right hypochondrion, which extends to the right shoulder, and jaundice comes on. These symptoms are not, however, always present, and the diagnosis is often very difficult. The liver may be also torn in consequence of a severe shock, and effusion take place into the cavity of the belly.

543. Wounds of the Liver are always very dangerous; if they penetrate deeply into the substance of the liver, the large vessels are torn, extravasation of blood and bile into the cavity of the belly occur, and they are to be considered as actually fatal wounds. If the wound be superficial, or adhesion take place between it and the peritoneum, it may perhaps heal; extravasation, inflammation and suppuration may, however, cause death.

[ASTLEY COOPER says he has "seen deep stabs with a pen-knife in the situation of the liver recovered from, after great inflammation of the abdomen. The patient was bled generally and by leeches, and fomentations were employed." (p. 224.)

Ruptures of the liver are not very unfrequent results of falling on the belly from a height upon some projecting substance. I have seen several of these cases. The last I had under my care was a boy about fourteen years, who fell upon a post; he lived four days.—J. F. S.]

544. Besides the most strict antiphlogistic treatment, these wounds require such position of the patient that everything can escape freely from

the wound. If bleeding continue, cold applications must be used, and a proper belly-bandage applied. If extravasation into the cavity of the belly take place, it must be treated according to the rules already given. If the wound suppurate, care must be taken for the proper escape of the pus, and the patient's powers must be supported.

545. *Wounds of the Gall Bladder*, which are even possible without injury of the liver, are usually characterized by extravasation of bile into the cavity of the belly, and are in general fatal; only when the gall-bladder is accidentally adherent to the peritoneum can the bile escape externally and a biliary fistula remain. In effusion of bile the belly quickly swells and fluctuates, respiration is difficult, the pulse small, quick, and compressed, the extremities are cold, the countenance very pallid and drawn in. These symptoms are not relieved by blood-letting. Obstinate costiveness, disposition to vomit, and actual vomiting occur. The small quantity of stool passed has a whitish colour, and the patient is jaundiced. This extravasation of bile is in general held as absolutely fatal. We have known but one case, in which, by three punctures made at different parts, a considerable quantity of fluid, exactly similar to bile, was discharged; it must be observed, however, that the evacuated fluid was not chemically examined (*a*).

Hœring (*b*) and Emmert (*c*) have injected bile into the cavity of the peritoneum, and found that great disturbance of the functions was always produced; but that the animals sometimes recovered. They found also that the injected bile was absorbed, and from these experiments, that it was the bile especially which produced these effects. They have also, after opening the belly, wounded the gall-bladder itself, and let the bile flow into the cavity, the consequence of which was death; this, however, must be also ascribed to the simultaneous affection of the other intestines by their protrusion and reduction. Autenrieth's opinion, that the effusion of bile into the cavity of the belly is fatal, by the abstraction of the oxygen, is contradicted by these experiments. In one case the wound of the gall-bladder was found healed.

It is important also to notice that, from the experiments of Dupuytren (*d*), it has been ascertained, that extravasation of bile and urine cause fatal symptoms, although neither fluid is perceptible on dissection.

[Gooch (*e*) quotes from the Philosophical Transactions the case of an officer who received a wound in the inferior part of the gall-bladder, without the adjacent parts suffering any considerable injury. The *abdomen* was immediately distended, as if the patient had been afflicted with an *ascites* or *tympanitis*, which continued till his death, about a week after receiving the wound. His bowels remained obstinately constipated, purges and clysters having no effect; and though considerable doses of opiates were given, they procured little or no ease. The external appearance of the wound was pale, crude, and flaccid On the fifth day he complained of nausea, and had slight hiccup; his pulse was strong, equal, and slow, till the day before he died, and then intermitted a little. His senses were perfect till death. (pp. 410, 11.)]

C.—OF WOUNDS OF THE SPLEEN.

546. *Wounds of the Spleen* are mostly fatal, on account of the large bleeding and the collection of blood in the belly. They require the same treatment as wounds of the liver (*f*).

[Astley Cooper (*g*) mentions the case of a man stabbed "with a dirk, which entered near the ensiform cartilage, and was nearly buried in the body. He was brought to St.

(*a*) Fryer, in Medic.-Chirurg. Trans., vol. iv. p. 330.

(*b*) Dissert. sistens experimenta de mutationibus, quas materiæ in cavum Peritonei Animalium ingestæ, tum in corpore efficiunt, tum ipsæ subeunt. Tubing., 1817.

(*c*) Meckel's Archiv. für die Physiologie, vol. iv. part iv.

(*d*) Sabatier, *loc. cit.*, vol. ii. p. 157.

(*e*) A Practical Treatise of Wounds, &c. Norwich, 1767, vol. i. 8vo.

(*f*) Hesse, Altenburgischen Annalen, 1825.

(*g*) Lectures, edited by Tyrrell, vol. iii.

Thomas's Hospital, pale, and extremely depressed; his abdomen became tense, and he died. Upon examining his body it was discovered that the dirk had passed from the ensiform cartilage, under the margin of the chest, into the abdomen on the left side, and that its point had penetrated the concave surface of the spleen. The cavity of the abdomen was filled with blood." (p. 226.)

He also mentions two cases, in which the spleen was torn from its attachments. In one, the spleen, after violent vomiting, produced a swelling in the groin, supposed to be a rupture. The vomiting continued, and at a week's end the patient (a female) died. The swelling was found to arise from the spleen, which had been detached from the diaphragm, and was enlarged by the interruption to the return of blood from the veins, although the artery still contained blood. The spleen was turned half round on the axis of its vessels. The other case was caused by a fall in hunting, and the patient died the next day. (p. 227.)

Ruptures of the spleen sometimes occur from the passage of heavy weights over the belly; and according to the size of the rupture and effusion of blood is the time which the patient lives after the accident. They usually are accompanied with other mischief of the abdominal *viscera*.

Instances have occurred in which the spleen has protruded through a wound in the belly, and entirely or partially removed, without material inconvenience to the patient. The history is well known of the soldier who was found, after the battle of Dettingen, with his spleen protruding, and covered with dirt. The surgeon, not liking to return it, cut it off, and the patient did well.

Another instance, of a somewhat similar kind, is mentioned by FERGUSON (*a*).

T. C. received, *Jan.* 5, 1734-5, a wound with a skane or great knife, which went through the muscular part of his fore arm, and into the left hypochondrion. In twenty-four hours after he was seen, and the spleen found out at the wound, and by the pressing and thrusting it with the fingers, in endeavouring to return it to its place, which those about him could not accomplish, and by being so long exposed to the air, it was quite cold, black, and mortified. FERGUSON therefore "made a ligature with a strong waxed thread above the unsound part, and cut off three ounces and a half of the spleen. Notwithstanding the ligature, there was a pretty large artery that sprung with great violence, which he immediately tied; and after bathing all the parts with warm water, he returned the remaining part of the spleen into its place, leaving the threads hanging out." On the tenth day the threads were removed, and the wound dressed. He was teased with difficulty in passing his water, which did not cease till the eighth day. Ultimately he got perfectly well.]

D.—OF WOUNDS OF THE KIDNEYS.

547. *Wounds of the Kidneys* penetrate either into the *cortical substance alone*, or into the *tubular substance.* In the former case blood only flows out of the wound, and according to its depth and direction we presume the kidney is injured; in the latter the blood mixed with urine escapes. Pain comes on in the region of the kidney, which spreads over the whole belly; the testicle becomes painful, and is drawn up spasmodically towards the abdominal ring; the urine discharged from the urethra is mixed with blood. If the peritoneum and the kidney be wounded at the same time, the urine is effused into the cavity of the belly, and fatal inflammation soon ensues.

548. The *treatment* of wounds of the kidney must be strictly antiphlogistic. The patient should lie so that everything may readily escape from the wound. If bleeding continue, cold applications must be employed. If retention of urine take place, from coagulation of blood in the bladder, it must be drawn off with a catheter. If an urinary fistula remain care must be taken for its cleanliness and for the escape of the urine; in most cases it is incurable.

(*a*) A letter containing an account of the extirpation of part of the spleen of a man; in Phil. Trans. vol. xl. 1737-38. p. 425.

E.—OF WOUNDS OF THE URINARY BLADDER.

549. The *Urinary Bladder* is most exposed to injuries, when full and raised out of the pelvis. These wounds, if the *peritoneum* be not injured and if the urine be not poured into its cavity, are generally not very dangerous. Besides the general antiphlogistic *treatment*, the urine must be drawn from the wound by a pretty large catheter, which is to be left in. When the wound is at the upper part of the bladder, the urine may be carried off by the introduction of a piece of partially unravelled linen between its lips. The dressing must be very light, and we must avoid stopping the wound in any way, or preventing the escape of the urine. Infiltration of urine into the cellular tissue must be prevented or removed by the position of the patient, by some enlargement of the external wound, or by proper incisions at any part where swelling and fluctuation can be felt (1).

The removal of foreign bodies which have penetrated into the cavity of the bladder requires especial consideration, because if they remain they may give rise to stone in the bladder (2).

[(1) The most common injury of the bladder is its bursting or tearing, in fracture of the pelvis caused by a heavy weight passing over it. I have never seen any other kind of wound. But in naval and military practice the bladder is occasionally wounded as in the following instances:—

In the Museum at St. Thomas's Hospital is the ball which caused

Case 1.—Colonel A., whilst in action before Alexandria, *March* 21, 1801, received a grape-shot through the right ischiatic notch, which, taking a circuitous route, passed through the pelvis without wounding any large vessel or nerve. came out under Poupart's ligament on the left side, and was found in his pantaloons. In its passage the ball had wounded both the *rectum* and bladder. The Colonel was removed from the Desert, on board the Trusty, under the care of Mr. Este, who found him sinking very fast. He however constantly applied poultices, as hot as could be borne, and gave him bark, camphor, ammonia, &c., with brandy and bottled porter, by which latter he was much refreshed. The physician-general, &c., &c., were called in consultation, who agreed that a recovery was impossible. The wound being gangrenous, discharged extremely, and was intolerably offensive. The fæces and urine passed through the lower wound, but there was no natural evacuation by the *rectum* or urethra. After some few days a favourable change in the wounds commenced; the sloughs separated, healthy pus was discharged, granulations were produced, and the wounds healed. The fæces at length and also the urine passed by their natural channels. When able to use crutches he was sent in a convalescent state to Malta. Stricture of the rectum ensued, of which he was cured by Sir A. Cooper, and some of the gold lace of his uniform came away.

The stricture of the *rectum* which occurred in this case illustrates the statement already made (*par.* 532) on this point.

Sometimes, however, the foreign body is passed by the natural passage, as related by Hennen, in the following

Case 2.—J. R., aged forty-four years, received a ball *July* 25, 1813, "through the skirt of his regimental jacket, which entered a little above the tuberosity of the left *ischium*, in a direction towards the *sacrum*, and lodged, as was supposed at the time, in the neighbourhood of that bone. The swelling of the soft parts was so considerable, and the general inflammatory symptoms ran so high, that when he was carried to the field hospital it was deemed improper to probe much after the ball. He was, therefore, freely bled, his bowels well opened, and emollient applications being made to the wound, he was sent down to the general hospital." After the inflammation had subsided, the wound was examined, "but with no other result than to convince the Surgeon that the ball did not occupy the situation originally imagined, but had passed onwards directly into the pelvis." The wound got well without much suffering, but after three weeks "there was every reason to suppose that the bullet was lodged in the neighbourhood of the bladder, for he complained of a dull sensation in the *glans penis*, with numbness and coldness of the testicles, attended with great pain in making water, and occasionally an inability to retain it; there was, nevertheless, neither stoppage nor tortuosity of the urinary stream." After about one hundred and thirty days from its infliction, or in the first week in December, the wound was completely healed, and he was sent to the convalescent depôt, where he remained six days, during which the uneasy sensations of the urinary organs arose to actual pain. For this he treated himself with getting drunk, and on the evening of the *8th December*, being attacked "with an irresistible desire to make water, after some severe straining, in which he was sensible of an obstruction about the neck of the bladder, which, for full half an hour, prevented the passage of a single drop of urine, he shot out of the *urethra*, with a convulsive jerk, a substance coiled up, somewhat in the shape of a fragment of a large bougie, nine lines in length, and three in breadth, the ejection of which was followed by a profuse flow of urine, passed without any muscular exertion, and succeeded by instantaneous relief. On examination of the ejected substance, it proved to be two bits of cloth, consisting of his jacket and its lining, corresponding with the size of the shot-hole. The texture was unaltered, but the colour of the red piece was much faded; it had neither any urinous smell, nor was any calcareous concretion observable upon it. * * * * Not the slightest trace of the ball could be discovered, either by the sound or by the finger introduced into the anus." (pp. 423, 24.)

(2) The ball extracted in the following case is also in the Museum at St. Thomas's.

Case.—M. M., aged forty years, a healthy sailor, was admitted into the hospital under the care of the elder Cline.

Feb. 20. 1812. It appears that in July, 1811, during an attempt to cut out a schooner, he received a shot in the right hip; the ball entered the *dorsum ilii*, obliquely downwards, within about two and a half inches of the *sacrum* and an inch above the ischiatic notch, whilst he was sitting pulling at an oar, which he continued to do for some time after. The wound bled profusely, and in a few minutes after he had great inclination to make water, which was done with great difficulty and pain, only coming away by drops On the following day he was carried to an hospital at Cadiz, where for three or four days he continued to discharge his urine only in drops, and accompanied with burning pain, when retention of urine took place which remained for four days, occasionally being relieved by the catheter; at the end of which time the cause was explained by a piece of shirting and of his trousers having made their way up to the orifice of the urethra, closely rolled up to about the size of a goose-quill, and two inches in length. Upon extracting this, by means of a pair of dressing forceps, the retention of urine was completely removed. During the time of retention, and then only, did urine mixed with bloody discharge pass out at the wound of the ilium. For several days after the extraction of the wadding there was a discharge from the urethra of thick, ropy, mucous substance, mixed with blood. The urine passed freely, but with heat and pain referred to the end of the penis, and a frequent desire to void his urine. These symptoms continued, except that latterly there was difficulty in passing his water. The wound had healed about a month previous to his admission into St. Thomas's, having a stiffness and pain in the motions of the limb. His health was not materially affected.

At the operation the bullet was found encysted on the left side of the bladder, much flattened, and having a small portion of bone adhering to it. He recovered very quickly after the operation.]

F.—OF WOUNDS OF THE WOMB.

550. If the womb be unimpregnated it cannot easily be wounded without wounding other parts, the treatment of which is of greater consequence; but if an injury occur to the impregnated womb, it is always connected with severe bleeding and the danger of a premature delivery. The bleeding is in general not stopped till delivery has taken place, which we must therefore attempt to hasten by breaking the membranes. Should the wound of the womb be so large, that the child partially or entirely enters the cavity of the belly, the wound must be enlarged and the child taken out.

["The fibrous, and as it were, cartilaginous resistance of the tissue of the womb, whilst empty," observes Duparcque (*a*), "the small size of the organ, its mobility, and its situation within a bony cavity efficiently protect it from all violence, either external or internal, capable of affecting the integrity of its walls. The development of this organ, or rather the gradual previous distension of its walls, becomes then the primary cause,

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(*a*) Histoire complète des Ruptures et Déchirures de l'Uterus, du Vagin et de la Périnée. Paris, 1836. 8vo.

the indispensable predisposition to its lesions; and as it is most commonly for and by the product of conception that this development is effected, the state of gestation thus becomes the usual though not exclusive predisposing cause of solutions of continuity of the womb, both spontaneous and accidental." (p. 12.)

In the *unimpregnated state* of the womb it may be burst by collections of blood in its cavity, as in the case under the care of Latour, of Orleans, in which a woman who had ceased to menstruate when forty years old, observed, when she was fifty, a swelling in her belly, which gradually and enormously increased, accompanied with insupportable pains; these ceasing suddenly, the swelling subsided, the patient became enfeebled, and died next day. On examination, the *peritoneum* was found full of blood; the womb was still expanded and wide open, its walls were firm and thick, but towards its *fundus* was a large tear; the neck was cartilaginous and entirely obliterated. In another case mentioned by Duparcque, the patient, who had left menstruating at forty-nine years, was attacked four years after with discharges of blood at irregular periods Some time after, the discharge ceased, and the belly swelled so as to descend to the knees. She had repeated vomitings of black matter like coffee grounds. Marasmus and death ensued. The womb was found enormously distended, and its walls extremely thin; its neck obliterated by a steatomatous tumour. The womb was full of fluid like that she had vomited, and in it was an aperture communicating with the stomach, to which it had adhered. (pp. 13, 14.)

In the ruptures of the womb which occasionally happen *during pregnancy* (*a*), it is said that "the body is the only part liable to this injury, for the *cervix uteri* continues to be, until the very end of gestation, the thickest part of the organ, whilst its situation within the pelvis defends it from external injury. The causes which most frequently produce this accident act from without, either mediately, as when violence is inflicted on the *abdomen*, or immediately, as when the contraction of the abdominal parietes themselves occasions the accident. The pregnant *uterus*, like a bladder filled with water, can yield but little to compression, and if it is subjected to force exceeding a certain degree it gives way. Ruptures thus produced take place as by *contrecoup*, that is to say, the rent takes place at a distance from the part on which the violence was inflicted, and thus it happens that the *uterus* usually gives way near its *fundus*, or a little to one side." (p. 487.) "The accident invariably proves fatal to the *fœtus*, and generally, though not always, it causes the death of the mother. Sometimes the mother dies from the sudden shock to the nervous system, but her death is oftener the result of hæmorrhage and of the consequent effusion of blood into the *abdomen*. In some cases, however, where the entire *ovum* has escaped into the *abdomen*, the contraction of the *uterus* suppresses the hæmorrhage, or the retraction of the vessels, which takes place especially in a lacerated wound," [certainly not, but rather by the sheathing of cellular tissue, with which the torn ends of the vessels are surrounded.—J. F. S.] "prevents a copious bleeding. If the woman has survived the immediate perils of the accident, the dangers of inflammation of the *uterus* and *peritoneum* still await her, and often terminate her life. Still there are several cases on record in which the patient has ultimately recovered, and not only lived for years, but has even given birth to living children." The extruded *fœtus* in these cases is enclosed in a pseudo-membranous cyst, which has sometimes undergone calcareous transformation, and remained from twenty to forty-six years. "In many cases recovery is very imperfect, and the contents of the *uterus* when expelled into the *abdomen* excite inflammation and suppuration; the bones of the *fœtus* are discharged through the *vagina*, *rectum*, or abdominal parietes, and the patient dies worn out by protracted suffering." (p. 489.)

Duparcque observes "that the dangers to which a person is exposed by this accident depend not so much on the circumstance of the *uterus* being wounded, as on the hæmorrhage which may be produced, or on the inflammation and its consequences which may follow the escape of the *fœtus* into the cavity of the abdomen. * * * Towards the end of pregnancy the *cervix uteri* is often so dilatable, that an attempt to deliver by the natural passages might well deserve a previous trial (to the performance of the Cæsarean operation); or, if the *cervix uteri* were rigid, incisions might be made into it, a practice successfully adopted by Dr. Smith of Maidstone (*b*). When pregnancy is not far advanced, gastrotomy is the only means of interference within our power, and Duparcque thinks that its employment would afford a chance of recovery to patients who are now abandoned to almost certain death." (p. 489.)

(*a*) I have availed myself of my friend Rigby's review of Duparcque and Nevermann on this subject, in Forbes's British and Foreign Medical Review, vol. x., not having been able to lay hands till the very last moment on Duparcque, and being unable to procure Nevermann, whose work is a German translation of the former with large [illegible]ditions.—J. F. S.

(*b*) Medico-Chirurg. Trans. vol. xiii. pt. i.

As an example that rupture of the womb is not always fatal, the following case related by **Powell** (*a*) is here mentioned:—

Case.—After a lingering labour of three days, the bearing pains suddenly and totally ceasing, were succeeded by an immediate and a most excruciating pain of a different kind, accompanied with great anxiety of countenance, and other indications of extreme distress. * * * Upon examination, *per vaginam*, the head, which had before presented as well as every other part of the child, had receded entirely beyond reach. * * * The *abdomen* presented upon the whole an uniform surface, similar to what it usually does in advanced pregnancy. * * * The limbs of the child could not be felt through the abdominal walls, as usually happens in these cases. The rupture was found to have "extended along the whole course of the neck of the womb on the right side, including its orifice. The body of the *uterus* was much contracted, and occupying posteriorly towards the left side the space immediately above the brim of the pelvis. The delivery was effected by turning. * * * The *placenta* having been previously thrown off from the uterine surface, was found in the *vagina* immediately after the removal of the child, and withdrawn by the application of the slightest traction. No hæmorrhage nor descent of any portion of intestine succeeded to this result." She was at first exceedingly exhausted, but by careful treatment slowly revived. "After an interval of about eight days, pieces of organised structure, sloughy in their appearance, and very offensive from their putridity, escaped from the *vagina*. After this the uterine discharge assumed the character of laudable and healthy purulent matter." This continued for many days, and when it ceased "a healthy evacuation of the *lochia* followed. * * * The most urgent symptoms, such as extreme difficulty of breathing, incessant and violent coughing, and great pain of the *hypogastrium* upon attempting to change her position, continued greatly to harrass her. In the midst of these unpromising circumstances, a large quantity of purulent matter was thrown up from the chest in the midst of a fit of coughing, which had the effect of greatly relieving her most distressing symptoms. She continued to expectorate purulent matter for several days afterwards." She slowly mended, and two months after was discharged cured.

Rigby further observes, that "wounds of the *uterus* are among the most influential causes predisposing the organ to rupture in subsequent pregnancies or labours. Dr. **Merrem** of Cologne (*b*), struck with the frequent occurrence of rupture of the *uterus* in women who became pregnant, after having undergone the Cæsarean section, investigated the subject, and has shown that in the nature of the *cicatrix*, by which wounds of the *uterus* are very often closed, we have a sufficient explanation of the accident. It would appear that the wound is not unfrequently closed merely by *peritoneum*, or, in other cases, adhesions take place between the edges of the uterine wound and those of the divided abdominal *parietes*, and a fistulous opening into the womb has thus been formed, which continued open for months. Of course, in either of these cases, the uterine contractions in a subsequent labour would soon tear asunder this frail bond of union, and expose the woman to all the dangers of ruptured *uterus*. Sometimes, indeed, the wound is united by a different process, though one not much more secure." Thus **Merrem**, on performing the Cæsarean section upon a woman for the second time, found the former incision four inches long and three fingers' breadth wide. It was concave instead of convex, like other parts of the walls of the *uterus*, and was composed of white glistening fibres, with a dilated blood-vessel running close to either margin. In the twelfth volume of the Medico-Chirurgical Transactions, Mr. **Birch** relates the history of a woman who recovered from a rupture of the uterus. Nine years after, having married again, she became pregnant; during labour the *uterus* gave way, and four days afterwards the woman died. At the *post mortem* examination, at which we were present, no trace of the former rupture could be discovered; but its situation, as described by Mr. **Birch**, corresponded exactly to the place where the *uterus* had again given way. Dr. **Merrem** conceives "that these cicatrices cause rupture by preventing the natural development of the *uterus*, and by interfering with its regular contractions." (p. 490.)

Duparcque (*c*) says, that "the walls of the womb may be also partially torn, in consequence of the formation and accumulation of fluids, as, for instance, pus, within them; and mentions a case of **Morère's** (*d*), in which an abscess was formed on the front of the womb, in consequence of a fall upon the corner of a sink during the sixth month of pregnancy. It was only discovered after delivery, by its projection across the mouth of the womb during its recession, and was cured by a puncture with a straight bistoury guarded with lint to within four lines of its point." In another case under **Duparcque's**

(*a*) Medico-Chirurg. Trans. vol. xii.

(*b*) Gemeinsame deutsche Zeitschrift für Geburtskunde, vol. iii.

(*c*) Above cited.

(*d*) Gazette Médicale, 1833.

own care, in which it was requisite to use forceps, "fifteen days after delivery the patient complained of dull pain towards the rump-bone, and an unpleasant weight upon the *rectum*. The neck of the womb was felt projected forwards, its hinder wall prominent, and rounded at the bottom of the *vagina* and fluctuating. This was punctured with the bistoury, and did well. In another similar case, he also mentions that the abscess discharged itself spontaneously at the neck of the womb, and the patient recovered." (pp. 15, 16.)

The womb, *whilst impregnated*, is liable to be burst by external violence, as by blows or falls upon the belly, by squeezing against a wall, or by carriage-wheels passing over the body. Such cases are extremely dangerous, but not always necessarily fatal; a most remarkable instance of which is mentioned by the younger NAËGELE (*a*):—A healthy peasant woman, aged thirty-five years, and the mother of four children, in her fifth pregnancy, about six weeks previous to her expected delivery, received a violent blow on the belly from the pole of a waggon, which threw her down with great force; and at the moment she felt a severe tearing pain. She crept a little way from the waggon, and was carried home in a fainting condition. On coming a little to herself, she complained of a constant bearing down pain in the belly, which prevented sleep during the night; but she had no return of the fainting. When seen, her face was flushed; pulse 90, full and sharp; the bowels had been only once moved after several injections; she could pass water, but with pain and scalding. The belly was slightly tympanitic, but not tense; and between the navel and *pubes*, somewhat to the left, a round circumscribed tumour was felt, rising in the middle to the height of an inch and a half, but flattened off towards the sides, and about six inches in diameter. Upon the surface there was a slight bruise, and beneath, the *nates* and foot of a *fœtus* could be felt with the greatest ease. She complained of pain on motion, or on pressing the tumour; and on pressing the hand deep into the abdominal walls above the navel, it was believed that the *fundus uteri* could be felt. Examination *per vaginam* presented nothing unusual; the head presented naturally; neither blood nor water had come away from the *vagina;* she had no pains, nor were there any signs of incipient labour. The movements of the child, which had been very brisk before the accident, had ceased immediately after. The alarming symptoms usually observed in cases of ruptured womb were entirely absent. She was bled to fourteen ounces, on account of the headache and state of the pulse, and enjoined the strictest quiet. She went on several days without change, till the forenoon of the *4th July*, when pains came on, and in the course of the afternoon she was partly delived by the midwife of a putrid *fœtus;* but as it was not entirely expelled, NAËGELE's assistance was required, who saw her at four the next morning. The head had then descended and expelled; but neither bladder of membranes nor a drop of *liquor amnii* had come away. The *fœtus* having been delivered to the breast had stuck, and the midwife pulling at the body, which was highly putrescent, it gave way near the loins, leaving the rest behind. The *placenta* had passed without any serious discharge. The patient lay with well-marked symptoms of *metritis*. The belly was more distended than before, but the tumour itself had diminished; the parts of the child were less evident, but the *nates* and a foot could be distinguished. The slightest touch produced insupportable pain. On examination, the *os uteri externum* was found very high up, and sufficiently open to admit two fingers. A leg of the child projected into the *vagina*, and around it at the knee-joint the *os uteri internum* had firmly contracted. Attempts to bring it away were unavailing, from its putrid condition and the severe suffering they produced. She was now bled to sixteen ounces, to induce relaxation of the *os uteri*, but without success; the leg was then removed at the knee, warm fomentations applied, and perfect rest enjoined, with general antiphlogistic treatment. On the *8th July*, the tumour, which had inflamed, burst; a foot protruded, at which the midwife had pulled till the whole remaining part of the *fœtus* had been removed. On the *14th July*, NAËGELE saw her, and she was then comfortable, had little fever, and her appetite was good. In place of the tumour was a round circumscribed opening, about five inches in diameter and an inch and a half in depth, from which mucus was discharged. On the right the whole thickness of the abdominal wall was as if it had been cut through with a knife, beneath which the finger could be introduced for some extent; on the left side of the opening was a red globular mass, united with the abdominal teguments, and which appeared to be the womb, as it rose when the lower portion of that organ, was pressed up by the finger in the *vagina*. Below, the finger was stopped by adhesions, which had formed in all directions at the bottom of the abscess. On the right side a portion of intestine was seen. Mild dressing and poultices were applied, and

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(*a*) Neue Zeitschrift für Geburtskunde, vol. v.; and in FORBES's British and Foreign Medical Review, vol. v. p. 581.

nourishing diet ordered. On 19*th July* the opening had diminished to a third. She went on very well; the portion of intestine and the red-coloured mass gradually retracting, and a free discharge of healthy pus continuing. One of the inguinal glands suppurated and burst. On the 17*th Aug.* the opening in the belly was entirely closed, leaving only a slight scar.

"*Punctures*, or narrow tears made by an instrument more or less sharp, are," says DUPARCQUE, "not the least dangerous wounds of the womb. Their usual consequence is the dribbling off of the waters, wounding of the fœtus, and abortion." And he quotes a case from PLANCHON (*a*), in which a woman was thrust by a cabriolet against a wall, and stabbed by a long, large, square nail in the foot-board behind, half an inch on the left of the white line, and three inches from the navel. She suffered great pain; the waters mixed with blood escaped from the wound with a jet, and the draining ceased after fifteen hours; convulsions, hiccough, and vomiting ensued, and she died at the end of sixty hours. (p. 18.)

Instances have also occurred in which by the goring of cattle-horns, the walls of the belly and also of the womb have been simultaneously laid open, sometimes so extensively, that the child was discharged by it, as in DENEUX's (*b*) case, in which the child was not separated from the mother for an hour, and lived only eight hours; but the mother recovered perfectly in six weeks. At other times the wound is not sufficiently large to permit the child's escape at once, although it was subsequently brought away through it, as in SCHMUCKER's case (*c*).

The womb is also sometimes wounded in criminal attempts to produce abortion. My friend Dr. WALLER tells me he has a perfect recollection of a coroner's inquest on such a case, though unfortunately he cannot refer to it.

The *vagina* is also *occasionally torn*, either at its upper part near the womb, in its middle, or at its lower part in the ano-perineal region, or at the *vulva* (*d*). When the *vagina* is torn near the womb, it may be caused "by dragging or by direct pressure; the former results from uterine contractions, from recession of the womb in the attempts at delivery, or displacement of the child, or by every act of the abdominal walls, or every movement of the trunk which has the effect of drawing back and raising up the womb." (p. 215.)

The predisposing causes to these ruptures (*d*) are principally, the disproportionate size of the child to the passage, the narrowing of the *vagina* by old *cicatrices*, its recession by the bladder being distended with urine, or, specially, the *rectum* with hardened fæces, or by tumours in the substance or on the surface of the *vagina*, or the narrowness of the *pelvis* itself.

When tearing once begins at the upper part of the *vagina* it may continue till the womb is almost completely separated from it. The patient may be destroyed by hæmorrhage, which generally is disposed, according to DUPARCQUE, to escape externally, though it may flow into the cavity of the *peritoneum*. A loop of intestine may also be protruded through the wound by the labour-pains; but "the intestine is easily distinguished from the umbilical cord by the mesentery which fixes it, whilst the cord is entirely free. The *omentum* may be more easily mistaken for a piece of the membranes; but in either case it is not difficult to trace these floating bodies, and ascertain whence they come, and what is their nature." (p. 225.) In these cases the child may either remain in the womb, or partially or entirely escape into the cavity of the belly. (p. 222.) Tearing of the middle region of the *vagina* is far less serious than when in the upper third, and accompanied or not with tearing of the womb. "It has no inconveniences for the infant, which often in consequence gains a more easy and quick passage; and it does not compromise the life of the mother. But if they have not any immediate serious inconveniences, they often subsequently cause disagreeable and disgusting infirmities, which embitter existence," (p. 301,) as vagino-vesical or vagino-rectal fistulas.

Sometimes the head of the child, instead of passing through the external orifice of the *vagina*, drives downwards, and the *perineum* being very extensible will yield, and the child be born through it, without tearing into the *vulva*, of which I have known an instance. But more commonly the head takes the natural course and the vaginal edge of the *perineum* being stretched severely, suddenly gives way, and the whole is torn through to the edge of the *rectum*. The treatment of these cases will be hereafter considered.—J. F. S.]

(*a*) Traité complet de l'Opération Césarienne, p. 77.

(*b*) Essai sur les Ruptures de la Matrice, p. 35.

(*c*) Mélanges de Chirurgie, vol. lxvi. p. 354.

(*d*) DUPARCQUE, above cited.

VI.—OF WOUNDS OF THE PENIS.

551. Either one or both cavernous bodies, or the canal of the *urethra*, may be wounded, or the *penis* itself may be for the most part or completely cut off. The bleeding in these wounds is always great, and comes from the cells of the cavernous bodies, or from the special vessels of the *penis*.

552. If the wounding of the cavernous bodies be only partial, a close application of the edges of the wound is usually sufficient to stanch the bleeding. A catheter is to be introduced, the wound united with sticking plaster, and this supported by a circular bandage compressing the *penis*. The same applies to injury of the *urethra*. If a part of the *penis* be completely divided, each vessel must be tied as in amputation of that organ.

553. If in a strong erection, the *penis* be forcibly bent down, a tearing of the cavernous bodies, or rather of their fibrous coverings, takes place; the blood escapes through this opening into the surrounding cellular tissue, and fills it out like a bag, which is always filled with blood when the penis becomes erected (1). At last the blood coagulates in the sack, and subsequently inflammation, ulceration, and bleeding occur. If the swelling be large, the functions of the *penis* are completely destroyed by the great curving to which it is subjected. In this complaint nothing is to be expected from compression, or any other means; the only remedy is amputation of the *penis*.

[(1) This accident occasionally happens in chordee; and there is an example of the rupture of the spongy body in front of the purse, in St. Thomas's Museum. But it also sometimes occurs during *coitus*, of which one instance has been already mentioned, (*par.* 155, *note* 7,) in which great sloughing of the perineal parts took place.

The reviewer of this work in the Medico-Chirurgical Review (New Series, vol. ii. p. 161) says:—"We have witnessed some cases of it, (extravasation of blood in the *corpus spongiosum* during coition,) and have found the priapism to subside gradually as the blood became absorbed. We recollect some time back reading a case, in which a surgeon thought it necessary to cut into the *corpus spongiosum*, to relieve the extreme tension of the *penis*, and the patient ever afterwards lost the power of erection." This asserted loss of power of erection after cutting into the spongy body of the *penis*, is, I believe, generally incorrect. Our common practice in perinæal abscess from stricture, is to cut through the middle of the spongy body for an inch or two, but in such cases I have never known any occurrence of the alleged misfortune.

Professor MÖLLER of Elsingore mentions (*a*) a curious example of gangrene of the *penis*, which the patient attributed to having fallen on a hand-spike eight days before, and receiving a severe contusion on the region of the *pubes*. That such was not the real cause of the mischief was proved on the day following his admission, 22*nd April*, 1844, into the Royal Hospital, when "on removing the dead skin and cellular tissue, a deep suppurating wound upon the inferior side of the *penis*, anteriorly to the *scrotum*, was laid bare. In this a hard body, subsequently discovered to be a ring of metal, was found, completely surrounding the root of the *penis*. With some difficulty this ring was removed by means of a fine elastic saw, and, as it was one of that description usually employed to string keys upon in which the extremities are not united together, the affair was soon over. At one spot the ring was deeply hacked, in all probability by the patient himself during his endeavours to get rid of it. Through a perforation in the bulbous portion of the *urethra* flowed urine mixed with blood and some matter." Ten days after his admission he died under hectic symptoms. On *examination* there was found in the *urethra* a large ulcer, four and a half inches from its orifice. In the belly much urine mixed with matter. The *fundus* and a considerable portion of the *corpus vesicæ* in close adherence to the parts around, with great alteration of structure and consistence, almost gangrenous. On the *cervix vesicæ* were two small openings with rounded margins. Several small holes in the *fundus* seemed rather produced in the attempts to separate the bladder from the other parts, to which it had become so closely attached. On the external covering of the intestines was a considerable exuda-

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(*a*) Bibliothek für Laeger, 1844; and also in RANKING, W. H., M.D. Cant., Half-yearly Abstract of the Medical Sciences, vol. i. p. 124. London, 1845. sm. 8vo.

tion of plastic lymph, in some places almost amounting to pseudo-membranous consistency. A little matter was also observed, but in no place amounting to any quantity.

(2) I cannot assent to CHELIUS's recommendation of amputating the *penis.* The part should be cut into, and pressure employed, if the bleeding vessel cannot be found, or the torn bleeding tissue cannot be tied.—J. F. S.]

554. An injury not unfrequent after a fall on the *perineum,* or after severe contusion of that part, is tearing of the canal of the *urethra,* by which frequently the skin and cellular tissue are at the same time torn, or there may be only perceptible externally the mark of a severe bruise. Under these circumstances the tearing of the *urethra* may be presumed, if at the same time blood flow from its orifice. The characteristic symptoms, however, soon set in; great desire to make water, which the patient can only do with pain and imperfectly. The pain is felt especially at the seat of the bruise, but soon spreads over the whole *penis,* the purse and groins, on which parts a swelling forms, which soon enlarges, and, although very tense, appears infiltrated, becomes brown or violet, and runs into gangrene. If the tear in the *urethra* communicate with that in the skin, and the opening of the latter be parallel with that in the former, the urine may pass out freely thereby. By such injury of the *urethra* a large portion of it may be destroyed, and, in this way, an incurable urinary fistula produced.

555. The most important indication in this wound of the *urethra* is to prevent infiltration of the urine. If the symptoms be decisive that the canal of the *urethra* is torn, the catheter must be introduced with the greatest care, and inflammation prevented by a proper antiphlogistic treatment. If infiltration have already occurred, a cut must be made at the place of the bruise down to the *urethra,* and a catheter introduced. If the infiltration of the urine be already extensive, several incisions must be made to discharge the urine from the cellular tissue. The wound must be treated after the general rules; the catheter must remain in till complete scarring is effected. If the introduction of the catheter be omitted at first, or be impossible, it must be used when the inflammatory symptoms have subsided.

[When the *urethra* has been ascertained to be torn through in the *perineum,* whether there be an external wound or not, the catheter should be at once introduced; but if this cannot be done, a cut must be made through the *raphe* upon the catheter previously passed as far as it will go, and the wound being found, the catheter is then to be continued into the bladder, and there retained. If the catheter can be introduced without cutting into the *perineum,* free leeching of that part is necessary, and great attention from day to day to ascertain whether either urine be extravasated or pus be formed, as in either case upon their discovery an incision must be immediately made to prevent the serious mischief which will ensue from their confinement.—J. F. S.]

VII.—OF WOUNDS OF THE TESTICLE AND OF THE SPERMATIC CORD.

556. The inflammation accompanying *Injuries of the Testicle* is always very severe, and requires with the ordinary treatment of the wound, strict antiphlogistic treatment, as already laid down in inflammation of the testicle (*par.* 172.) If the testicle be destroyed by injury, or by the consequent suppuration in its organization, its removal is necessary.

Wounds of the Spermatic Cord, in which the nerves and vessels going to the testicle are injured, cause shrivelling or decay.

[Wounds of the testicle are very rare; but that organ may be wounded in tapping a small hydrocele, of which I believe I had an instance last spring. A man who had had hydrocele of large size for twenty years, was first tapped three years ago, a second time in June, 1844, and the third time in the early part of April, 1845; the swelling being then small and very little fluid drawn off, led to the presumption that the testicle must have been wounded. He kept quiet for a few days, and then returned to his work, but very soon the right side of the purse began to swell, to become red and painful, and these symptoms quickly increased so much, that he came to the hospital under my care, with the purse swollen to the size of two fists, very red and shiny, but not very tender; the swelling was pear-shaped, fluctuating unequally, in some parts soft and elastic but in others hard and firm. The body of the testicle could not be clearly defined, and the cord was very thick and dense. His bowels were cleared with colocynth and calomel an evaporating lotion applied, and the purse raised, so as to favour the return of the blood. In a few days, under this treatment, the swelling subsided and he was cured. This case shows the propriety of not tapping small hydroceles.—J. F. S.]

VIII.—OF WOUNDS OF JOINTS.

557. In *Wounds of Joints* (*Vulnera Articulorum*) either the capsular ligament only is opened, or the joint-ends of the bones are also injured in various ways. The direction and depth of a wound, and the spontaneous escape, or the escape produced by pressure, of a transparent fluid, (*synovia*,) declares its entrance into the cavity of a joint. Frequently, however, no *synovia* escapes, because the wound of the skin and of the capsular ligament have become displaced; and, on the contrary, the escape of a transparent viscous fluid is no certain sign that the wound penetrates the joint, as it may happen in a wound of a mucous bag. Probing for the purpose of determining the entrance of a wound into a joint is objectionable, because it may excite inflammation, and is only necessary in those cases in which the existence of a foreign body in the wound is to be ascertained. In large wounds the *diagnosis* is easy.

558. The danger is always great in wounds of joints, and depends in general on the inflammation caused by the injury itself, or by the entrance of the air or of foreign bodies. Cuts and stabs often heal without any particular symptoms; and this may be expected if the cavity of the joint be not long exposed to the contact of the air, if the joint-ends of the bones be not injured, and if no blood be effused into the joint cavity. Bruised wounds, especially shot-wounds, are extremely dangerous.

["It is from the disposition that the cavities of joints have to fall into the suppurative inflammation when an opening is made into them," says John Hunter, "that union by the first intention does not take place. The greatest care should be taken to put this in their power if possible, for as they do not readily run through the regular stages of inflammation, they give rise to the more violent symptoms. When they suppurate it is very tedious, and then the parts are apt to die and slough, which makes these accidents of such dangerous consequence. In cases of wounds, I should think a simple bandage would be best. We should avoid making stitches, because they tend to produce inflammation." (p. 449.)

Astley Cooper says:—"In young and healthy constitutions, these wounds in the largest joints are recovered from; but in aged and weak persons, they destroy life. Upon dissection in the first stage, suppurative inflammation of the synovial membrane is found; in the second stage, the ligaments of the joint are thickened, and the synovial membrane in part ulcerated, in part granulating. The cartilages are absorbed; granulations arising from some parts of the bones, and exfoliation taking place from other portions." (pp. 250, 51.)]

559. The *treatment* of chops and cuts into joints is the same. After the joint is put in a proper position, the wound must be united in the closest manner with sticking plaster, and, if possible, the parallelism between the wound of the skin and that of the capsular ligament must be

got rid of. The wound is to be covered with a compress, and the joint kept in the most perfect quiet, being steadied with splints and with a circular bandage. The patient must be put under strict antiphlogistic treatment. If no inflammation ensues the wound heals quickly ; but if the wound be long exposed to the influence of the air, if the patient move the joint, if the treatment or dietetic relations be not suitable, if there be a dyscrasic disposition, or if the wound itself be very large, frequently soon after the accident, oftentimes some days after, a severe pain comes on in the joint, which, at every motion, is remarkably increased; tense, shining swelling, and great heat ; the edges of the wound swell ; a quantity of thin serous fluid is discharged ; the swelling often spreads over a greater part of the limb ; the fever is very high, frequently accompanied with wandering and with spasmodic symptoms. The swelling at last loses its tension ; suppuration in the joint takes place, oftentimes also under the skin at greater or less distance from the joint ; the skin breaks, the suppuration deteriorates, the pain continues, and death ensues, either sooner from the severity of these symptoms, or from the copious ill-conditioned suppuration, and the gradual consumption of the patient's powers, if amputation of the limb be not had recourse to at the proper time. The most happy result under these circumstances is the uniting of the joint-ends of the bones (*Anchylosis.*) Only by a suitable practice from the very first can the dispersion of the inflammation be effected.

[ASTLEY COOPER's treatment of "a wound in the knee-joint from one to two inches in length, consisted in a fine needle and thread being passed through the *skin only*, (avoiding the ligaments,) and bringing the edges of the external wound together; for a wound in the joint is different to most (all) others, as the *synovia* has a constant tendency to force a passage outwards, and it is more abundantly secreted than usual, so that adhesive plaster is apt to be separated and union prevented : lint, therefore, dipped in blood, is applied over the surface of the wound-plaster over it; then the surface of the knee is to be covered with soft linen dipped in a lotion of *liq. plumb. subacet.:* after which a splint is placed below the limb to prevent all motion of the injured joint, and positive rest is enjoined." (p. 251.)

The employment of stitches is, for the reason assigned by JOHN HUNTER, improper, and therefore unadvisable. But as ASTLEY COOPER justly observes, the increased secretion of *synovia* has a constant tendency to burst the edges of the wound apart. Controlling the secretion of that fluid, as far as possible, is therefore a material point in the treatment, and can only be effected by keeping down the increased action of the vessels of the part with the application of cold evaporating lotions.

With this view, the practice advised by ABERNETHY, and which I have employed successfully, is, I believe, the best. He did not use any stitches, but having fixed the limb in the position in which he purposed it should remain, (and the bent posture is best, so as to be provided in case suppuration and destruction of the joint should ensue,) he carefully brought the edges of the wound together with sticking plaster; and then having brushed the plaster over with a varnish of sealing-wax and spirits of wine, which hardens in a few minutes, it was rendered impervious to moisture; so that without detaching the plaster and depriving the wound of its support, a piece of linen dipped in evaporating wash could be laid over the whole surface of the joint, and repeated, as necessary, so as to regulate the temperature and inflammatory action.

ASTLEY COOPER's advice that "purgatives should be as much as possible avoided, and a rigid abstinence enforced," (p. 252,) cannot be too strongly insisted on. The object is to produce speedy union, which if the case do well, is effected in two or three days. But if the patient be constantly moving about, as happens when the bowels are acted on by purgatives, the joint is disturbed and suppurative inflammation will ensue.—J. F. S.]

560. Inflammation accompanying wounds of joints requires large repeated bleedings, but especially local blood-letting with leeches ; the most perfect quiet of the joint, and the continued use of cold applications, by which it is most probably to be prevented. But if the swelling be already

large, warm applications are to be used, and in great painfulness, together with proper antiphlogistic treatment, internal and external narcotics are also to be employed.

561. If suppuration occur and the pus cannot readily escape from the wound, so soon as fluctuation is distinct, its escape must be provided for by a cut, and its further collection prevented. The joint is to be put into a proper position, and kept perfectly at rest; moist, warm poultices are to be laid over the joint, or the opening of the abscess only superficially dressed; internal strengthening medicines are at the same time to be given and a nourishing diet, if the powers be diminished by the continuance of the suppuration. If the whole joint swell, it must be rolled daily with a circular bandage. Such position is to be given to the part as will be most suitable when anchylosis takes place.

562. Large chops and cuts of the knee and finger-joints, which penetrate either through or into the bone require amputation.

563. In shot-wounds of joints, their size, the neighbourhood of large nerves and vessels, the proportionate injury of the ends of the bones, the constitution of the patient and the other relations concur in determining whether immediate amputation of the limb be necessary, or whether its preservation should be attempted. (*See* GUNSHOT WOUNDS.)

The wounds of different joints are in this respect of different degrees of importance; that of the knee is most dangerous, because rest is least possible. Only in the case in which a ball has opened one side of the joint, when no decided injury of the bone, or of the vessels and nerves therewith connected, and the pus readily escapes, may the preservation of the limb be attempted. Shot-wounds of the joints, of the hand and feet, not unfrequently permit the preservation of the limb; in these, however, the enlargement of the wound is always necessary, and subsequently the introduction of a seton. These spongy bones are never subject to *necrosis*, and are never replaced by bony substance, but by approximation and by the formation of soft cartilaginous parts.

IX.—OF DIVISION OF THE ACHILLES' TENDON.

PETIT; in Histoire de l'Académ. des Sciences, 1772, p. 51; 1728, pp. 8 and 231.

RAVATON, Pratique moderne de Chirurgie, Paris, 1776, vol. iv. p. 379.

MONRO, A., The Cure of a fractured Tendo Achillis; in Essays and Observations Physical and Literary, vol. i. p. 450. Edinburgh, 1754. 8vo.

DESAULT, Œuvres Chirurgicales.

WARDENBURG, Von den verschiedenen Verbandarten zur Wiedervereignigung der getreunten Achillessohne, und den Mittelnsie zu verbollkommnen. Götting., 1793. 8vo.

AB AMMON, F., Physiologia Tenotomiæ experimenta illustr. Dresd. 1837. fol.

HUNTER, JOHN, Lectures; PALMER's Edition, vol i.

564. *The division of the* ACHILLES' *tendon* is either the consequence of a tearing, in which the skin is not injured, or of a wound. In the former case the division of the tendon is always complete, in the latter it may be complete or partial.

The tearing of this tendon is most commonly the result of a false step, or of a spring by which the point of the foot suddenly receives the whole weight of the body. At the moment of the tear the patient hears a snap, as if a nut were cracked, has the sensation as if he had stepped into a hole, and is incapable of supporting himself on the injured foot. On examination both ends of the tendon are found separated, and between them is a hollow which is increased by bending the foot upwards, and diminished by bending the knee and pressing the foot down; the calf is drawn upwards. The patient rarely suffers much pain immediately after the accident; inflammation generally comes on later.

If the sheath of the tendon be torn, without the tendon itself being divided, a hollow is felt, in which the edges of the torn sheath separate and swell; but if the foot be moved, the tendon is felt slipping up and down in the cavity.

["I believe," says JOHN HUNTER (*a*), "fracture of this tendon often happens when a person is fatigued and off his guard, as after dancing, &c., and after the muscles have acted spontaneously, as in the cramp; at least it happened to me after dancing, and after a violent fit of the cramp. * * * We generally find that the muscle is thrown into a state of cramp when the tendon gives way, losing the power of relaxation by the will or of itself. * * * But the pain often leads to the right mode of cure, the patient squeezing the muscle down with his hands, which a Surgeon should do if at hand." (p. 437.) "When the *tendo* ACHILLIS is broken, there is but very little inflammation attendant; but some general fulness comes on about the small of the leg and ankle, the skin looks dark from the effusion of blood, and the parts have a firm feel, from coagulable lymph being thrown out. This firmness of the cellular membrane increases near to the fracture laterally, and this assists to keep the tendon in its place." (p. 438.)]

565. The two ends of the tendon are united by an intermediate cellular substance, which gradually becomes firm. If this be considerable, the motions of the foot are thereby interfered with and are unsteady. In wounds a hard callous scar is produced, which is connected with the intermediate substance, and so prevents the motions of the foot.

566. The *treatment* consists in the close apposition of both ends of the tendon, and the continued preservation of this position. This indication is supplied *by bending the leg, outstretching of the foot, and diminishing the contraction of the muscles of the calf.*

[JOHN HUNTER says:—"The parts should be allowed to remain nearly in their natural position; no inconvenience will attend a small separation of the broken ends of the tendon, namely, half an inch or so; whereas considerable disadvantage would arise if we were to push the two broken ends together by throwing back the heel (which has been the general practice.) The only circumstance that would seem to forbid such practice, namely, letting the broken tendon remain without a bandage, is, that the muscle will lose half an inch of its power of contraction, which the motion of the ankle may or may not lose: but though this may be lost at first, we know muscles will acquire it again afterwards, and therefore no attention need be paid to this objection. The advantage of not throwing the heel up, and of allowing the tendon to heal nearly in its natural position is, that the patient may be enabled to walk from the very beginning of the cure, a very desirable circumstance. However, it is not necessary to adhere rigidly to either of these modes of treatment, but to adopt a medium between the two, which will be best. The heel may therefore be a little raised during the time of walking only, by raising the heel of the shoe. A roller should be passed several times round the calf of the leg, and kept constantly applied, as we cannot guard against the involuntary action of the muscles; and at night we may apply an apparatus consisting of a leathern slipper or sock, with a strap from the heel to be fixed to a belt in order to steady the muscles. * * * As I would not restrain the patient from walking almost from the very beginning, (the inflammation may prevent it for the first day or two,) it is necessary to give him some directions how he is to manage the muscles under the cure, as walking cannot be performed in the usual way. I have recommended to keep the position of the foot nearly at a right angle with the leg, as in standing, but not quite so, the heel being a little raised, by some pieces of leather put into the shoe, which may be removed one by one. When he walks he must turn his toes out, and carry the inside of his foot forwards, without attempting to bend the joint of the knee; indeed the latter precaution is unnecessary, for this motion is only necessary when the heel can be raised from the ground, which he cannot do. The patient will hardly be able to mend his pace for two

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(*a*) Lectures in PALMER's edition, vol. i.

months, except it be by getting familiar with his present mode of walking." (pp. 437, 38.)]

567. Various apparatus for bringing the two ends of the tendon together have been employed, which more or less correspond to the indications stated. To these belong the *bandage*, and the peculiar *shoe* or slipper.

A few cases are known in which, after tearing of the ACHILLES' tendon, union has occurred without surgical assistance; but these little support the opinion of BIBRAC and others, that the simple care of the patient not to bend the foot, assisted by constant rest, is sufficient for that purpose.

568. The *bandages* proposed by GOOCH, PETIT, SCHNEIDER (*a*), DESAULT, and WARDENBURG, produce, besides fixing the position of the foot and knee, a compression of the muscles of the calf, which prevents their retraction. In cases where the separation of the ends of the tendon is not great, a moderately curved splint applied and fastened upon the instep is sufficient.

GOOCH covered the leg with compresses and cotton, and bandaged it, with the foot straight and the knee bent, from the lower part of the thigh to the toes. PETIT's bandage consists in the application of a longuette, from the bend of the knee, over the calf and heel, to the very toes, which are fastened by numerous circular bandages to the knee; and by the rolling round and drawing together of their ends, the foot is kept extended with the knee bent. DESAULT modified this bandage, by filling the hollow on both sides of the ACHILLES' tendon with charpie and graduated compresses, and the application of the languette to the under part of the thigh. For the certain preservation of the extension, a splint should be applied on the ankle-joint and instep, as SCHNEIDER also has recommended. WARDENBURG has endeavoured to render the bandaging most safe; by bending the knee and straightening the foot, he brings the two ends of the tendon into contact, or, if this cannot be done without danger, into opposite approximation; if a space still remain between the two ends, this must be got rid of by simply drawing down the calf, when it can be done in a few days. The hollows on both sides of the tendon are then to be filled with charpie, and the region of the tear rendered so level that the rolling may produce equal pressure. If there be a wound, it must be covered with wadding; a long pad is then to be applied of sufficient length, that at the lower end it should project somewhat beyond the toes, and at the upper end above the knee-joint, and at both parts should be bound lengthwise. With a three-finger-wide roller some circular turns above the calf are to be made around the leg, (beneath which also some thick compresses, as large as one's hand, are to be laid, for the purpose of keeping down the muscles of the calf if they have been much drawn up,) and carried in spiral turns to the injured part, where the end of the bandage is to be fastened. With another longer bandage, after having fixed the lower end of the long pad as firmly as the proper direction of the foot requires, the foot is to be rolled from the toes to the ankle-joint; one or two turns are then to be made over the last turn of the first bandage, and the two turned-over ends of the long pad fixed. For the purpose of giving the limb its proper firmness, two cylindrical splints of wood or iron plate filled with linen or flannel, are to be applied on the knee and instep, from the toes to the middle of the thigh, and fixed by broad straps, which are drawn through buckles on the splints. If there be a wound, the turns

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(*a*) Chirurgische Bibliothek, vol viii. p. 708.

of the bandage over it only, are to be removed for the purpose of dressing it.

Edmonston, A. (*a*), employs, instead of the bandage generally used in tearing of the **Achilles'** tendon, strips of sticking plaster, which give the leg greater steadiness.

569. The *slippers* of Petit, Ravaton (*b*), Monro (*c*), and the *sole-slipper* (*d*), are different in their operation, as in the two former the foot is outstretched and the knee at the same time bent; in the two latter, the foot is outstretched, the muscles of the calf drawn down, but the knee is not kept bent. They do not answer, therefore, perfectly to any of the indications laid down, (hence do they require the assistance of bandages (*e*)), and their application is always accompanied with difficulties. Graëfe's slipper (*f*) is more suitable than the others; it consists of a shoe open upon the instep, and held together with several straps; it is connected by an iron rod, like that used in distortions, to a knee-piece, and this, by means of a hinge, with a calf-piece.

Graëfe also uses the knee-piece of this apparatus in transverse fracture of the knee-cap, and in tearing of its ligament; as well as the whole apparatus in anchylosis and contraction of the knee-joint.

570. Bandaging has manifestly decided objections. The bandages easily give, become loose, and are not retentive in the same degree; neither flexion of the knee-joint nor extensionof the foot is at our command. The renewal of the apparatus is always troublesome, and exposes the patient, especially if there be a wound, to the danger of again tearing through the scarcely united ends of the tendon; and so long as the apparatus remains on, the injured part cannot be looked at.

571. The after-treatment is simple. In wounds of the Achilles' tendon, inflammatory symptoms may require antiphlogistic treatment. The union of the tendon takes place within from four to six weeks; the slipper or bandage is then to be taken off, and the curved splint is to be applied, only at night, upon the instep, for the purpose of keeping the foot properly extended. When the patient begins to walk, he must have a shoe with a high heel, which is to be gradually lowered, and the foot brought to its natural position. The stiffness which often remains for a long while ceases by frequent motion and by the use of volatile rubbing; as does also the hard projection observed after healing on the part where the division has existed.

According to the indications mentioned in tearing of the **Achilles'** tendon, the treatment of tears of other tendons may be easily determined. (*par.* 321.)

X.—OF TEARS OF MUSCLES.

Pouteau, Mémoire sur la Luxation des Muscles, et sur leur Traitement; in his Œuvres Posthumes, Paris, 1783, vol. ii. p. 277.

Theden, von der Flecksenausdehnung und Verrückung der Muskelfasein; in his Neuen Bemerkungen und Erfahrungen, vol. ii. p. 195.

Beclard, Additions à l'Anatomie Générale de **Bichat**, p. 215.

Ueber Muskel und Sehnen-Rupturen; in **Hennemann's** Beitragen Meklenburgischer Aerzte zur Medicin und Chirurgie, vol. i. part i.

(*a*) Edinburgh Medical and Surgical Journal, 1821, January.

(*b*) Above cited, plate xxxii.

(*c*) Ib., plate v. fig. 1–9.

(*d*) Beinstein, Systematische Darstellung des chirurgischen Verbandes, p. 520.

(*e*) Mursinna, Neue medicinisch chirurgische Beobachtungen. Berlin, 1796, p. 193.

(*f*) Journal für Chirurgie und Augenheilkunde, vol. v. 2, p. 309, plates ii. iii.

572. Some muscular fibres, or even whole muscles, are often torn by a severe and sudden stretching of the muscles, in a false step, and the like; this occurs most readily in the long narrow muscles, where the muscle begins to be tendinous, and, according to **Wardrop** (*a*), especially in the muscles of the calf. The consequences of such tearing is severe pain, increased by motion; a hollow often observed at the torn part of the muscular fibre, and difficulty or complete incapability of motion. The inflammatory symptoms are often very severe, and a large swelling, to a greater or less extent, occurs. The limb must be put in such position that the injured muscle shall be relaxed, in order to effect union. The muscular fibres must be brought into apposition by the application of bandages, and strict rest must be persisted in; and the passage of inflammation into suppuration sought to be prevented by proper antiphlogistic treatment, especially cold applications.

Barlow (*b*), who himself suffered this accident, advises large bleedings, application of warm water, and rolling. He considers gentle motion advisable, and complete rest hurtful. The torn ends cannot be brought into contact, and thus there is not union by the first intention.

[I have seen one instance of that very rare accident a transverse tear of the *m. rectus femoris*, and another of the *m. biceps flexor cubiti*, both of which were near the attachment of their muscular fibres to their inserting tendon. I do not recollect how the second case originated, but the muscular end was drawn up to the middle of the upper arm, and formed a semiglobular swelling beneath the skin, and below it was a deep gap. In the first case, the patient was walking along the street, at his ordinary pace, when he felt, to his surprise, as if he had received a smart stroke across the thigh, and immediately dropped. He managed, however, to hobble home, a few hundred yards. I saw him next day, and found a large hard lump on the middle of the front of the thigh, which could be readily moved from side to side, and below it, between the two *m. vasti*, a large hollow, extending nearly to the knee. He was kept in bed, with his knee and leg much raised above the pelvis, and a circular roller applied around the thigh, from the groin to the detached end of the muscle, but not below. In the course of a few days the spasm of the muscle relaxed, and the swelling of its extremity subsiding, it again united, though I presume by an intermediate substance with the tendon below. After six weeks he walked nearly as well as usual.

Palmer (*c*) says that the tendon of *m. triceps extensor cubiti* is sometimes torn.

Grantham mentions (*d*) a case in which after six weeks there was still a very large swelling from the *m. rectus femoris* being drawn one-third up the thigh, with a corresponding depression above the patella: walking caused great pain in the thigh. There was not any tendency to approximation of the divided cords by an intervening ligamentous substance, and the Surgeon was unable to effect any good by position or pressure. I cannot understand why there was difficulty in this case if it were properly treated at first.—J. F. S.]

(*a*) On the Laceration of the Fibres of the Muscles, particularly of the Internal Gastrocnemius; in Med.-Chir. Trans., vol. viii. p. 278

(*b*) Case of Laceration of the Fibres of the Gastrocnemius Muscle; in the Edinburgh Medical and Surgical Journal, 1823, July, p. 358.

(*c*) His Edition of Hunter's Works, vol i. p. 436.

(*d*) Facts and Observations in Medicine and Surgery.

B.—OF FRACTURES OF BONES.

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KORZENIEWSKY, Jos., De Ossibus Fractis Tractatus. Vilnæ, 1837.

MEYER, F. G., Die Lehre von den Fracturen. Berlin, 1843.

573. *A Breaking or Fracture of a Bone* (*Fractura Ossium*, Lat. ; *Knochenbruch*, *Beinbrüch*, Germ. ; *Fracture*, Fr.) is the sudden solution of continuity of a bone, depending on external violence, or on the violent contraction of muscles.

574. In fractures of bones are distinguished, 1. Whether a bone be broken in one only or in several parts at once ; 2. Whether only one or both bones of a limb be broken ; 3. The direction of the fracture ; hence the *transverse*, (*Fractura transversa*,) *longitudinal*, (*Fractura longitudinalis*,) *oblique fracture*, (*Fractura obliqua*,) according as the ends of the bones correspond in a *horizontal*, *vertical*, or more or less *oblique* direction. Longitudinal fractures occur simply with simultaneous splitting of the bone, or with a simultaneous transverse or oblique fracture ; without these they are very rare ; still they have been observed in the thigh-bone (GAEDEKE, CAMPAIGNAC) and in the shin-bone (WERNER, CLOQUET) ; 4. Whether the fracture be combined with splintering of the bone, *comminuted* fracture (*Fractura comminutiva*) ; 5. Whether beside the fracture there be no other injury, *simple* fracture (*Fractura simplex*) ; or whether at the same time there be injury of the soft parts, either from the violence which caused the fracture, or by the ends of the broken bones, a *compound* fracture (*Fractura complicata*.)

Fractures are also divided into *complete* and *incomplete;* **Boyer** (*a*) rejects this distinction as groundless, but he here manifestly goes too far. **Meding** (*b*) has, in his experiments on dogs, frequently found the shin-bone broken merely half through, although he had produced the fracture with considerable force, as was proved both by the loud crack and by the mobility at the place of fracture. I have also not unfrequently observed in young children, where, after violence, a fracture was found, and pain, swelling, and mobility indicated its place, yet that there was not the least trace of projection of the ends of the fracture, nor crepitation to be perceived. The not uncommon curvature of such young bones, after external violence, also proves the comparatively greater yielding of the tender bones to external pressure, so that the bony fibres which suffer the greatest extension break, whilst the others merely bend, like the cracking of fresh willow. **Boyer**'s assertion is therefore to be restricted to the bones of adults.

575. Fractures of bones, like all solutions of continuity, may be produced under any circumstances, if only sufficient violence be used; they, however, occur more readily according to the different position and function of the bones, the age of the person, and the diseased changes of the bones. Superficial break more frequently than deep-seated bones; so also do those which on account of their functions are more exposed to the operation of external injuries. In advanced age the nutritious process in bones is altered, and the deposit of phosphate of lime is greater; they therefore lose their elasticity, and become more brittle, and break more easily. The greater frangibility of bone in age and during other diseased states, depends on its diminished cohesion from the excess of absorption over deposition, by which the resistance of the structure is lessened. The same changes of structure of bone may be produced by diseases which especially affect the bony system, for instance, *syphilis*, *gout*, *rickets*, *scrofula*, *scurvy*, *and cancer*.

External violence causes the separation of the bone not always at that part on which it operates, but frequently at a greater or less distance from it, by propagation of the shock, or indirectly by the counter-blow. In the former case, severe bruising of the soft parts always accompanies the fracture. The external injury often produces only a violent contraction of the muscles, which causes the fracture. This is possible even in tubular bones; hence violent cramps and convulsions also may cause fracture of bones. In a very great degree of *brittleness* or *fragility of bone* (*c*), the external violence often need be but very slight.

Various opinions have been advanced in regard to the changes which the substance of bone undergoes in advanced age. According to **Bichat** (*d*), the quantity of lime increases; others, however, state that the bone becomes more porous. According to **Mercier**'s numerous investigations (*e*), the compact tissue in the middle of the tubular bones of old persons is tougher and closer than in adults, it rings when struck, is hard and difficult to splinter. The calibre of the medullary cavity is indeed larger, but only at the expense of the internal spongy layers, which almost entirely disappear; but near the ends of tubular bones an increased absorption is observed, by which their substance is thinned. Here the spaces in the spongy tissue are larger in proportion as they are near the medullary canal, and which seems to increase to the very end of the bone. This important difference explains why the porosity of the ends of tubular bones in old persons contributes more to their fragility than the want of elasticity in their bodies, which is otherwise balanced by their greater toughness. Hence in old people fractures at the ends of tubular bones, and especially at the upper part of the thigh-bone, are very common, but equally rare in the middle of tubular bones, and perhaps even more rare than in middle-age persons.—**Pigné** (*f*).

(*a*) Above cited, p. 9.

(*b*) Ueber Knock-Wiedererzeugung; in Zeitschrift für Natur und Heilkunde, Dresden, 1824, vol. iii. part iii. p. 305.

(c) **Nicod**, Dissert. sur la Fragilité des Os, et sur la contraction musculaire considérée comme cause de fracture. Paris. **Rostan**, in Nouveau Journal de Médecine, etc. vol. i. p. 138. **Rumpelt**, Ueber den Ursprung der sogenannten freiwilligen Knochenbrüche; in **Rust**'s Magazin, vol. xlii. pt. 3.

(*d*) Anatomie Générale, vol. iii. p. 80.

(*e*) Gazette Médicale, vol. iii. p. 561. 1835.

(*f*) In the French translation of **Chelius**'s Handbook.

576. The *diagnosis* of Fractures is grounded—

1. *On the changed form and direction of the limb.* The operation of external violence, the movements of the limb, and the activity of the muscles, displace the ends of the bone more or less (*a*), *according to the thickness of the limb*, in which the ends of the fracture have still one part of their surface in contact, and are more or less drawn on one side (*b*); *according to the length of the limb*, in which the broken surfaces are completely separated from each other, and lie near to or upon each other; (*c*) *according to the circumference of the limb*, when the limb, at the time of the accident, or immediately after, rotates, and the one or other end of the fracture follows this motion (*d*); *according to the straight direction of the limb*, when the ends of the fracture are not separated from each other, but are more or less bent at an angle. The ends of a fracture are frequently little or not at all displaced, when of the two bones of a limb only one is broken, the fractured part being furnished with a tough fibrous envelope, or the broken surfaces, by means of their relations, mutually support each other, or the one end of the fracture is wedged into the other, as in fracture of the neck of the thigh-bone.

2. *On the disturbance of the function of the limb.* The motion of the limb is not always immediately prevented, except when of the two bones of a limb only one is broken, or when there is not any displacement of the fractured ends, or if a locking have occurred.

3. *On unusual mobility of the part and crepitation in rubbing together the ends of the fracture.* In order to ascertain this the limb must be fixed at two different parts with the two hands, and the ends of the fracture are to be attempted to be moved, whilst the one is slightly separated from the other.

Further, the patient feels at the fracture, severe darting pains, and considerable swelling arises. Easy as is the diagnosis of fractured bones in many cases, yet may it be also difficult, if the bones be covered with much soft parts, if swelling be already present, and the displacement of the ends of the fracture be not very great, or if of the two bones of a limb only the more slender be broken and kept in place by the other.

According to LISFRANC (*a*), by the assistance of the stethoscope, the existence of a fracture in any part of the body, except the skull, can never be doubtful. The swelling cannot prevent its perception, as on the slightest motion, crepitation is produced. But this practice must almost always be useless; for if crepitation exist, it is distinguishable without the stethoscope; and if it exist not, the stethoscope furnishes no new sign.

577. The *prognosis* of fractured bones varies, *according to the condition of the bone, according to the direction and complication of the fracture, according to the age and constitution of the patient*, and *according to his behaviour during the cure.*

If the fracture occur in a bone to which strong muscles are attached, its ends are much displaced, and it is difficult to keep them in their proper position. Oblique are more untoward than transverse fractures; they very often are united with shortening of the limb; and the same happens in double fracture. The more the soft parts are injured, and the greater the accompanying splintering of the bone, the more dangerous is the fracture; especially when large nerves or vessels are wounded by the splinters, in which case the inflammation is always very great; gangrene, copious suppuration, and so on, often follow. Fractures of bones are of less con-

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(*a*) Archives Générales de Médecine. Aug. 1, 1823.

sequence in children than in adults, partly on account of predominating reproduction, and partly on account of the less contractile power of the muscles. In more advanced age reproduction already has declined, and phosphate of lime is very largely deposited in the bony tissue; hence the fracture heals with more difficulty. All diseases which alter the nutrition of bone, (*par.* 575,) as well also as a great degree of weakness, more or less prevent the cure of the fracture. Although pregnancy, in so far as the living activity is then concentrated at another point, may retard or hinder the firm union of the ends of the bone, yet numerous observations show that in general this is not the case.

578. When the ends of the fracture are early brought into a corresponding position, and there retained, they unite in the same way as divided soft parts, (*par.* 272,) that is, the ends of the bone inflame, are glued together by a gelatinous substance, and the vessels shoot into this connecting mass; the connexion is at first yielding, till by deposition of phosphate of lime it becomes hard. For the first ten or twelve days there is swelling of the soft parts, which gradually subsides, and then a circumscribed swelling remains around the ends of the bone. Hitherto the patient feels crepitation at every motion. Between the twelfth and twentieth day, it may be ascertained that the ends of the bone are actually connected, although only slightly and flexibly. Gradually the union becomes firmer, and between the thirtieth and sixtieth day motion ceases.

The earlier opinions which have been advanced regarding the structure of the mass (*callus*) that connects the ends of the fracture, are more or less one-sided and partially false, as sometimes they have derived it from a secreted glutinous and gradually hardened matter, sometimes from organization and ossification of the blood; sometimes from scarring and ossifying of the *periosteum* or of the medullary membrane, sometimes from the production of granulations. The union of the ends of the fracture must be accompanied with those of the divided soft parts, only that in the former the connecting intersubstance undergoes the same changes as the formation of bone in its natural development. The processes which take place on the ends of the fracture are (as experiments on animals prove) the following: effusion of blood occurs in the cellular tissue, to a greater or less extent, covers the muscles and the fracture, is firmly attached to the ends of the fracture and seems to proceed especially from the medullary canal and *periosteum*. The blood gradually becomes paler and tougher, the *periosteum* swells and reddens, and beneath, as well as subsequently out of the medullary canal, a jelly-like mass capable of being drawn into threads is deposited. The swollen soft parts are daily connected more firmly by the intersubstance, which presents a soft reddish and externally fibro-cartilaginous tissue through which the aponeuroses and muscles pass, and in which the *periosteum* attaches itself, or is formed by the surrounding muscles and cellular tissue. In this mass bony points are first produced, at the greatest distance from the fracture, and the middle of the callus is at last ossified. The new bony mass is more firm than the rest, though this does not depend on its own greater firmness, but on the mechanical relations of the shell of the bone becoming thicker and thicker by the deposition of bone; the medullary cavity is also usually filled with it, although subsequently the bony canal is partially reproduced. As, however, broken bones are united by actual bony tissue, so, after the perfect ossification, there can be no question of peculiar callus and of different structure and substance from the original bone. The structure of new bone varies in part according to the period of its growth, partly according to the perfection or imperfection of its condition, as observed in preparations.

Dupuytren distinguished, according to the above-described symptoms, *two periods* in the formation of bone. In the *early period*, the ends of the fracture are retained as in a brace, by the softened *periosteum* and swollen soft parts, and by the new bone deposited from the *periosteum* and medullary membrane, whilst the intermediate substance attains the condition of fibro-cartilage. This state, continuing to the thirtieth or fortieth day, he calls *provisional callus*. In the *subsequent period*, the ossification of the cartilaginous intersubstance takes place, not before the fourth or sixth month; absorption first removes the swelling of the soft parts, and then, after from six to twelve months, the bony mass in the medullary canal is removed, whereby this canal is restored. This **Dupuytren** calls the *definitive callus.*

For the literature of Callus, see

Duhamel, in Histoire et Mémoires de l'Académie des Sciences. 1739–43.

Dehtleff, Dissert. seu Ossis Calli generat. et natur. per fracta animal. oss. demonstr. Götting., 1753.

Marrigues, Dissert. sur la Conformation du Cal. Paris, 1783.

Villermé; in Journal Universel des Sciences Médicales, vol. xxviii.

Meckel, J. F., Handbuch der Pathologischen Anatomie. Leipz., 1818. vol. ii. pt. ii. p. 62.

Breschet, C., Recherches historiques et expérimentales sur la Formation du Cal; in Concours pour la place de chef des travaux anatomiques à la Faculté de Paris. Paris, 1819. 4to.

Scarpa, De Anatome et Pathologiâ Ossium Commentarii. Ticini. 1827. sm. fol.

Reypers, Dissert. de Origine et Natura Calli. London, 1833.

Meding, above cited.

Weber, M., Die Wiedervereinigung der Knochen: in Verhandl. der K. L. Academie der Naturwiss. vol. xx. 2.

Miescher, above cited.

[**John Hunter**, in speaking of *the period of union and the manner in which this effect takes place* in simple fracture, says:—"The time in which the bone will be united will depend on circumstances. In the soft parts union will often take place in forty-eight hours; but it will require much longer time in bones. In the first place, they cannot be brought so closely in contact, therefore a large quantity of new matter must become vascular; secondly, there is the second or ossific process to be effected; thirdly, there is laceration of the soft parts; fourthly, the state of the constitution and restorative powers may be weakened; fifthly, age. The situation of the bone, too, will cause a variation; the lower requiring a longer time than the upper extremities. In the middle-aged and of a good constitution, union will take place in three weeks, so as not to admit of perceptible motion. If much longer in uniting, it will be uncertain at what time this will take place; I have known it months, and yet unite at last. This slowness seems to be from imperfection in the two first bonds of union, the adhesive and the cartilaginous; sometimes from a want of disposition to ossification." (p. 503.)

Various observations and experiments have been made on brutes, mostly rabbits and dogs, for the purpose of ascertaining the mode in which fractures are reunited; some of the most important of these I shall now recite.

Breschet (*a*) and **Villermé** (*b*), whose inquiries into the re-union of fractured bones are, as **Miescher** observes, "without doubt the most ample and complete," have distinguished five principal periods in the course of this process.

First period.—*From the first to the sixteenth day.*—At the onset the effused blood[1] is found in all the soft parts, after which inflammation and swelling principally of the cellular tissue appears; the neighbouring parts of the bone itself become paler, and produce with the hardened cellular tissue a regular, almost cartilaginous substance. The *periosteum* is rent in pieces about the fractured part, is separated from the bone, and between them both a small quantity of viscid matter is seen; the *periosteum* on the tenth day has swollen to the thickness of two-thirds of a line, and adheres firmly to the muscles and to the hardened cellular tissue. The *medulla* is torn asunder, and the blood poured from it forms a stopple in the medullary canal; within it also blood is exuded, and the colour of the *medulla* is consequently more dingy. From the fourth day the *medulla* assumes a brighter red colour and more solid, then becomes whitish, and the substance produced by it, soft at first, becomes cartilaginous, and at last osseous, adhering with the bone itself. The surfaces of the fracture are at first concealed by coagulated blood; presently a little viscid matter is seen on them, which gradually increases in quantity, becomes firmer, is seen to proceed from the medullary canal, and covers these surfaces, which, from the tenth day, are somewhat smoothed and rounded, and at last unites with the neighbouring soft parts. This is their *substance intermédiaire.*

(*a*) Recherches historiques et expérimentales sur le Cal; in Concours pour la place de chef des travaux anatomiques. Paris, 1819.

(*b*) Dictionn. des Sciences Méd., vol. xxxviii. p. 416, Article—*Ossification du Cal.*

Second period—*Fibrous or fibro-cartilaginous state, from the sixteenth to the twenty-fifth day.*—The cellular tissue nearest the external surface, again softens and returns to its healthy state, whilst the soft parts below are daily more firmly united with the intermediate substance, and with it distinctly bound the circumscribed swelling of callus, in which the fragments of bone are, as it were, involved. This swelling consists principally of two substances, of which the outer, whitish, cartilaginous in appearance and density, here and there entirely cartilaginous, lies over the bone to some distance from the seat of fracture, and at the most distant point from the fractured part now presents the hardness and appearance of bone: the internal substance of the swelling is reddish and thin, adheres closely to the surfaces of the fracture, but more loosely to the first denuded surface of the bone not yet altered, and thus forms an intermediate substance; both tissues gradually and indefinitely pass the one into the other. The *periosteum*, swollen at those parts which have now become changed into cartilage and bony matter, is easily distinguished and separated, but around the middle of the fracture appears entirely united with the swelling of the callus. The medullary tube is obliterated with compact or porous bony substance.

Third period.—*From the twenty-fifth day to the third month.*—Ossification commences at the part most distant from the fracture in that fibrous substance which is changed into cartilage, whilst, at the same time, the red intermediate substance is converted into fibro-cartilage. Thus the whole swelling at length becomes bony; still, however, there may be some motion, and if the bone be cut lengthways with a saw, a white streak will be observed traversing the callus in the region of the fracture, with which the swollen *periosteum* is adherent. The medullary tube is obliterated; the soft parts have returned to their healthy state.

Fourth period.—*Bony state; from the third to the sixth month.*—The streak is still seen for a long time on the external surface, either with the *periosteum* more firmly adhering, or with a little remaining groove; within, as soon as the larger medullary cells begin to be formed, it disappears.

Fifth period.—*Diminution of the Swelling. Restoration of the medullary tube.*—The bony substance filling the medullary tube becomes cellular; the cells enlarge, and at length entirely disappear, and in their stead the healthy *medulla* appears. In the callus also cells are produced, and the size of the swelling being simultaneously diminished, the external crust becomes compact.

From this digest of the observations of **Breschet** and **Villermé**, which is given by **Miescher**, from whose work I have copied it, it appears, as he says, that these writers, "although they consider the formation of the callus does not so much originate from the *periosteum* alone as that it is formed between the bone and the *periosteum*, in this respect, however, agree with **Dupuytren**, that they confirm the double formation of bony substance; of which the one, produced in the external surface as well as in the medullary tube, afterwards disappears, (*cal provisoire,*) whilst the other, formed between the fractured parts themselves, remains and by degrees becomes more firm (*cal définitif.*)" (p. 119-121.)

Miescher, endeavouring to settle the disputed points in regard to the production of callus, proposes to himself the following questions:—"Whether, according to the laws of nature, it can be that the inflamed *periosteum* can be converted into bone; which seems from **Weber**'s observations to be effected; **Breschet**, **Villermé**, and **Meding** hold that the plastic substance exuded from the internal surface of the *periosteum*, can alone be ossified, which, however, **Scarpa** entirely denies is ever converted into bone. The other question, whether really there be a formation of bony substance, such as **Dupuytren** says is formed, temporary or provisional, or not at all; if it exist, what is its nature, what its purpose? It is also very doubtful whether the bone itself remains unchanged, or, being softened, is rounded by absorption, wastes, or lastly is loosened up and swells." (p. 125.) Our space will not permit following the interesting history of **Miescher**'s inquiries upon these points, and we must therefore be content with the following summary which he has given of their results:—

"To one considering these observations, the theory of the formation of the callus appears extremely simple; for it is produced, as in every reunion, by the first intention, by the exudative inflammation of all the parts injured by the fracture; but the bony callus originates from that exudation which proceeds from the bones. We observe the inflammation first in the soft parts, the *periosteum*, the cellular tissue, and the muscles; all which becoming swollen, hardened, and consolidated together, surround the fracture with, as it were, a pretty firm capsule. The inflammatory exudation is clearly perceived in the internal surface of this capsule, from which I have frequently noticed that reddish semi-fluid substance produced which gradually becoming firm is provided with vessels, and not unfrequently has the appearance of kernels or caruncles. By the same inflammation there springs from the medullary tissue, at the place of fracture, a soft reddish substance which covers the surfaces of the fracture, and coalescing with the matter exuded from the soft parts, produces the intermediate substance. All these materials poured forth from the inflamed soft parts into the cellular-fibrous texture, are as usual changed, and fill the intervals between the fragments, whilst the muscles, cellular tissue, and *periosteum* gradually return to their former condition. The bone itself is then attacked with inflammation, first indeed at those parts where the flow of blood and nutrition have not been disturbed, that is, on the external surface, where the *periosteum* has not been torn from the bone, and on the internal, where the vessels of the *medulla* and of the bone are still united together. Hence is exuded a reddish white, transparent, gelatinous fluid, scarcely differing from that poured out in inflamed soft parts. This, by vessels gradually forming in it, is changed into an organic tissue, and whilst at the one part it increases in quantity, at the other, and first indeed where connected with the bone, it is converted into cartilaginous and bony substance. Thus, within, is the medullary tube obliterated, near the fracture, with new bony matter; without, this substance protruding gradually, and propagated from both fragments towards the fracture, at length stretches beyond the bare surface of the fractured ends, and at last, as it may chance, connects both, either throughout their whole extent, or only here and there, Such is the formation of PRIMARY CALLUS. Whilst these processes are going on, the surface of the bone first bared unites with the capsule formed by the soft parts, and with the prominent part of the primary callus itself, but the edges of the fracture with the intermediate substance; by which means the flow of the humours being renewed, by it also is the formation of bony matter, that is, the formation of the SECONDARY CALLUS, produced. From all these parts, then, which I have mentioned, new bony materials gradually increasing in turn come nearer, and the intermediate substance which in the mean while had occupied the ligamentous structure, being got rid of, they at length unite together. Thus does callus arise from the bony substance projecting on every side from the fragments near the fracture; and is gradually perfected in exactly the same way as the original bone itself. Which concluded, it becomes part of the bone itself, and at last is so consolidated with it, into, as it were, one body, that oftentimes, even with the assistance of the microscope, it cannot be determined what should be assigned to the callus, what to the original bone." (pp. 141, 42.)]

579. The callus often does not attain its proper degree of hardness in the usual time, which depends on the insufficient contact of the broken surfaces, on the frequent movements of the limb, on the already often mentioned dyscrasic diseases, on much advanced age, or especially on weakness of the living activity, and on considerable tearing of the *periosteum*. The broken ends are connected in these cases either merely by a cellulo-fibrous mass, and are in apposition or not, or they scar and include neighbouring parts between them; the ends of the bone remain movable, and the natural motions of the joint are either completely prevented or rendered very difficult: thus *an artificial, unnatural joint*, is produced.

Fracture of the neck of the thigh-bone, (within the capsule,) of the *olechranon*, of the knee-cap and heel-bone, in most cases do not unite by bone, but by a tough cellular intersubstance. This partially depends on the violent muscular action which displaces the ends of the fracture, and partly on these bones being covered with a thick, tough, tendinous tissue, which causes the want of external ossification and swelling of the *periosteum*, as well as the change called by DUPUYTREN, provisional callus, which keeps the ends of the fracture in sufficiently close contact for ossification. Experiments prove that the *periosteum*, both in the neighbourhood of the *epiphysis* and where the tendinous expansion spreads over bones, is loosened with more difficulty by inflammation, and that no bony matter is deposited (*a*). From this circumstance, the opinion that want of the *periosteum* is the cause of want of union, has especial value. The great looseness of the fragments, the yielding of the muscles, the small surfaces, capable of touching, of the little substantial knee-cap and *olechranon*, are to be borne in mind, as well also as to the poverty of vessels in the isolated head of the thigh-bone; and it is therefore readily perceived that the ossification of the inter-substance must be subject to great difficulty. But the opinion, that *bony* union never can take place, is not true (1.)

(*a*) MEDING; above cited.

(1) The usual absence of union in these fractures must be attributed solely to the difficulty of keeping the fractured surfaces in close apposition and at perfect rest, to both of which conditions the muscles offer great obstacles. But if these can be overcome, there is ample proof, as will be hereafter specially shown, that such fractures can unite. And that want of union does not depend on want of power to secrete bone, is proved by the large masses of bone often produced about the fractured parts, although no union occurs, of which examples in fractures of the neck of the thigh-bone, of the condyles of the upper arm-bone, and of the coronoid process of the cubit, are in the museum at St. Thomas's, as well as in many others.—J. F. S.]

580. If the ends of the fracture touch only partially, they unite at that part alone, and mostly this partial connexion is surrounded with a considerable *growth of callus.* This is also the case when the ends of the fracture are split. The growth of callus may be therefore consequent on a too loose bandaging, because the broken ends are not thereby kept in apposition.

581. The *treatment* of fractures consists generally,

1. *In the proper disposition of the fracture, if the broken ends have been displaced.*

2. *In retaining the ends of the fracture in their proper corresponding position with a suitable apparatus.*

3. *In preventing and getting rid of the consecutive symptoms.*

582. Before proceeding to the arrangement of the fracture, the parts must be carefully unclothed; and also, in the necessary transport of the injured party, great care must be taken that the ends of the fracture be not more displaced, and do not injure the soft parts.

The *setting* (*Repositio,* Lat.; *Einrichtung,* Germ.; *Reduction,* Fr.) of the fracture consists in overcoming the contraction of the muscles by *extension* and *counter-extension,* and then by *direct pressure, to bring the two ends of the fracture into actual contact* (*Conformatio, Coaptatio.*)

Extension and counter-extension are made by assistants, the one holding the limb below the upper, and the other above the lower joint of the broken bone, and drawing in opposite directions; but first always in that of the lower piece of bone, and afterwards in that of the limb. When sufficient extension has been made, that is, when the ends of the fracture are somewhat separated from each other, the Surgeon, grasping them with both hands, must endeavour to bring them into corresponding position and contact, and to smooth all irregularities.

583. The retention of the limb in this position depends on the *apparatus,* during the application of which the proper degree of extension and counter-extension must be kept up. The apparatus must completely enclose the whole limb, by its regular pressure must render the displacement of the ends of the bone impossible, and prevent the motions of the limb. For this are requisite—1st. The *swathing* of the whole limb with several strips of bandage, (or with the eighteen or twenty-tailed bandage,) or in the upper extremity with a common circular bandage, after a compress has been put upon the seat of fracture (1). These parts of the apparatus must previous to their application be moistened with a resolvent lotion, as for example, lead wash, if continued moisture seem fitting for the prevention or diminution of severe inflammation, otherwise they should be applied dry, and are to be put on neither too tight nor too loose. 2dly. The *application of splints.* These are either flexible and take on the form of the limb, as splints of pasteboard, of leather, of flexible wood, of wooden or fishbone rods sewed up in linen; or they are inflexible, of firm wood, or of lead, more or less corresponding to the form of the limb (2). The firm unyielding

splints are most suitable for all fractures of large bones, as those of the lower extremities. Only in children, or in fractures of small bones, may flexible splints be used, which are fixed with a roller or with separate straps. Of the inflexible splints those made of firm wood, and which are quite straight, are the best. Between these and the limb, bags filled with chaff are to be applied throughout the whole length of the latter, to equalize their pressure (3). These splints should, if possible, be so large as to project over the neighbouring joints; on the lower limbs they should be applied on both sides, enclosed in a sufficiently large cloth, and fastened with several straps. They render the so-called *straw splints* quite superfluous (4).

The fracture-plasters (*empl. catagmatica* of the ancients) are to be rejected on account of their irritating properties. Many, however, employ *empl. sapon.*, in order to diminish the pressure of the apparatus, especially in those bones which are merely covered with skin.

[(1) No compress should ever be applied upon the seat of fracture; it is quite unneeded, as the position of the limb should put the broken ends in proper place; it is very improper, as it may cause ulceration of the interposed soft parts.

Neither should any bandage, on any account whatever, be applied at first; the constriction it produces by becoming tightened, as swelling comes on, is at the least inconvenient, as the bandage must be loosened again and again; for if not, severe and unnecessary pain will be produced to the patient, and gangrene may follow, of which I have seen examples. Even after all swelling has subsided, I think fractures do quite as well, if not better, without any other bandage than those necessary to confine the splints, as the limb is thereby less heated.

(2) As presently shown, the use of starched or gummed rollers, which drying, exactly fit the limb, and form a firm strong case to it, are commonly used, in many fractures, in preference to any splints.

(3) The best material for padding splints, is thick flannel or blanket, in three or four layers, and covered with linen.

(4) The treatment of simple fractures by the *immovable apparatus*, as it is now called, has within the last few years greatly superseded the use of splints, except in very oblique and unmanageable fractures. A method of this sort was known to and mentioned by CHESELDEN (*a*), who says:—"I had learnt it from Mr. COWPER, a bonesetter of Leicester, who set and cured a fracture of my own cubit, when I was a boy at school. His way was, after putting the limb in a proper posture, to wrap it up in rags dipped in the whites of eggs and a little wheat flour mixed; this drying grew stiff, and kept the limb in a good posture. And I think there is no better way than this in fractures, for it preserves the position of the limb without strict bandage, which is the common cause of mischief in fractures." (p. 38.) Elsewhere, in speaking of the treatment of club-foot, CHESELDEN (*b*) gives a plate showing the application of this bandage, from which it appears he put on single strips of linen diagonally upon the leg, and crossing each other in various directions; and he makes one observation worth remembering:—"There is no bandage so equal as this for a fractured leg. I always use it, leaving that part upon the *tibia* very thin, that if it grows loose by the abatement of a swelling, I can cut out a piece and bend it closer. Upon a journey I once set the cubital bone of a gentleman's arm that was broke; and, making use of this bandage, he the two next days rode long journeys without any inconvenience." (p. 453.)

The reintroduction of an apparatus, on nearly the same plan, is due, I believe, to JOHN LAWRENCE of Brighton. Its advantage consists in the formation of light, close-fitting cases or moulds of the limb, which, as they dry, are amply sufficient to keep the bone and surrounding parts in proper place, and at the same time to permit free movement of the *whole* limb, and if it be the leg, even of bearing the weight of the body and walking upon it, without disturbance of the position of the bone, and without interference with the process of union. This treatment, as efficient as it is simple, has also the advantage of relieving the patient of the irksomeness of keeping his bed for several weeks, as so soon as the bandage has become dry, he may be allowed to get up and move about without fear of retarding his cure. There is also in this plan, whatever the modification of it may be, the advantage that the linen case fits much more perfectly than any wood or tin

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(*a*) The Anatomy of the Human Body, 11th Edition, 1778.

(*b*) See his Additions to the Translation of LE DRAN'S Operations in Surgery by GATAKER, 3rd Edition, p. 1737.

splint however carefully padded, and that the materials are always at hand in every house, and of the most trifling expense.

The first method I saw employed, and which I first used, was that of linen splints and a roller, according to LAWRENCE'S plan. The splints are made by covering one side of the limb with a piece of linen or lint soaked in water, and of rather larger size than the splint is proposed to be. White of egg and flour well mixed, and of the consistence of very thick cream or batter, is spread over three or four strips of linen, each about three fingers' width, and of corresponding length with the limb; and these, one after another, are laid upon the lint with their spread surface downwards, and the edge of each, after the first, a little overlapping the other. All the air is to be got from beneath the linen, by gently passing the finger from one end to the other, but always one way, or the splint will not be even; and when the whole has become well applied to the lint, then a layer of short strips, also spread with the egg and flour, are to be placed across the long ones from one end to the other, and each a little overlapping the other, as in the first layer, and the whole to be carefully pressed down and the air discharged as before. A second layer of long strips is then to be applied, over this a second layer of cross strips, and then a third layer of long strips, all spread with the mixture, completes the splint. Great care must be used in pressing out all the air, otherwise the splint is weak; but if this be well done, then as the linen and the mixture dries, the splint becomes as tough and unyielding as a board, and fits like a mould to the limb. During the drying of the splint, which usually occupies twelve or sixteen hours, the patient must be careful to keep his limb in the position in which it has been placed, or the splint will be disturbed and harden awry. This constrained position, even for so short a time, is the principal inconvenience and objection to this mode of treatment. On the next day, if the splint be tolerably dry, it should be carefully removed, the edges cut smooth with a sharp knife, and then a little pressed out with the thumb, to prevent them digging into the skin and causing a sore. After this the limb is to be turned over and laid upon it, and then the other side of the limb to have a splint made like the former. Care must be taken that the edges of the splints should be at least half an inch asunder, so that they should not jostle each other, nor prevent a little pressure being made upon them by the roller, nor hinder their drawing together subsequently when the limb has shrunk, which it usually is after a fortnight. On the third day the last-made splint is to be removed, its edges pared and pressed out, and then replaced. The limb is now raised, being kept in place by the splints, and all are to be swathed, from end to end, in a roller of six yards length, which having been soaked in pretty thick starch, is first rolled up, and then carried round spirally, and with as many reflexes as may be necessary to make it lie even; after which the whole is to be gently pressed down, and brushed over with starch, and then the limb laid in an easy and convenient position to dry. On the fifth day the patient may leave his bed and move about, either carrying his foot in a sling, or bearing upon it as he may be disposed. The starched bandage generally needs renewal at the end of a week or fortnight, on account of the shrinking of the soft parts; but very commonly nothing more is requisite till the entire removal of the splints.

A much more simple, and equally efficient, treatment is a starched or gummed roller, without even linen splints, closely applied three or four times over the whole limb, which has been first covered with lint. The gummed roller is that which in our hospital practice is almost alone used in fractures of the leg, either of one or both bones, and in fractures of both the upper and fore arm.

In the employment of either of these methods care should be taken that neither should be used till the swelling has completely subsided, that is, not till the lapse of five or seven days after the accident, during which time the limb may either lie simply on a pillow, or be temporarily put up lightly in wooden splints. I do not think it prudent to put the apparatus on immediately after the accident, for very often the swelling and consequent pain from its tightness will compel its removal; or if left untouched there will be the same danger of mortification as from tightly-bound splints of the common kind.

Various materials have been proposed with which the roller should be spread, or in which it should be soaked, a number of experiments on the composition of which have been made by SMEE (*a*).

TAVIGNOT (*b*) has recently proposed the use of oil varnish in the treatment of fractures of the lower limbs of young children, where by the constant moisture of the urine the common apparatus falls to pieces. He first applies a starch bandage, and

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(*a*) On the Composition of Moulding Tablets for Fractures, &c.; in Lancet, vol. i. p. 833, 1838–39.

(*b*) Examinateur Médical, Aug. 1841; and FORBES' British and Foreign Medical Review, vol. xii. p. 544.

when that is quite dry, brushes over its whole external surface, alſo the upper border and part of its internal surface with varnish; then dries it in the sunshine or by artificial heat, and, two hours after, repeats the varnishing. Over such bandage the urine passes without in the least softening or disturbing it; and TAVIGNOT says it has the further advantage of being removed without cutting the bandage, merely by putting the limb into warm water, which insinuating itself dissolves the starch, and allows the roller to be easily taken off.—J. F. S.]

584. This (the *Simple Contentive*) apparatus is sufficient in transverse fractures, and in such as are not very oblique. But if the fracture be very oblique, this apparatus will not, in the least, prevent the displacement of the ends of the fracture, as it affords them no support, and therefore they are always readily displaced by the action of the muscles. This especially happens in fractures of the lower limbs, where in order to counteract the contractions of the muscles, a *continued extension* of the limb by means of particular contrivances is most proper. It must, however, be remarked that the extending force, so far as possible distributed over the limb, should be applied above and below the neighbouring joints, and increased or diminished at pleasure, as otherwise inflammation, excoriation, and mortification, are produced by the pressure.

585. The position of the limb during extension and counter-extension, (*par.* 582,) as well as during the cure, should always be that in which the muscles are most relaxed. Therefore in fractures *in the middle of tubular bones*, *the straight position* is to be preferred; but in fractures *in the neighbourhood of joints*, *the half-bent position*, because, as the flexor muscles are attached to the bones above and below the joints, they always drag in the direction in which they bend, and the two ends of the fracture are best kept close together if the joint be retained in a half-bent position. The exceptions which occur in reference to this rule will be noticed in the special treatment of fractures. Only when the fracture extends into the joint, and stiffness is feared, must the limb have that position during the cure, which, should stiffness take place, will least hinder its motions; therefore in the lower limbs the straight, in the upper limbs the half-bent, which also is the most suitable, as in that only can the arm be properly fixed.

[The rule laid down by CHELIUS in the beginning of this paragraph, in regard to putting the limb in a half-bent posture, so as to relax the muscles, is perfectly right; but the exception he makes at its conclusion is equally wrong. There is no reason to expect stiff joints to occur more frequently in the lower limbs than in the upper; and, indeed, experience proves that they rather more commonly happen in the upper than in the lower limbs. But in the latter, a bent posture is much preferable to an extended one, as the patient walks infinitely better with a bent knee than with a straight one. Stiff joints are, however, except when the fracture extends into a joint, and even then not always, rather uncommon. I admit that, generally, in fractures of the lower limbs, I prefer the straight position when the fracture is of the thigh, not, however, in regard to any consideration of the possible stiffness of the knee-joint, but because I believe it answers the purpose equally well as the bent position, and gives the patient the opportunity of varying his posture, which is not a trifling advantage and comfort to him.—J. F. S.]

586. When the apparatus is applied, and the limb put in a proper position, care must be taken that it is neither neglected nor displaced· From time to time it must be moistened with the resolvent wash, and the bandages tightened when they yield (1). When the apparatus becomes loose (mostly about the fifth or sixth day) it must be re-applied, and as often as it does not keep firm, at which times the broken ends of the bone must be always brought into their proper position, if they have become displaced. The general treatment requires attention only for the first few days, and should be antiphlogistic. In common cases after proper arrangement no peculiar

symptoms are observed. The apparatus must only be removed when the connexion of the bone is complete, otherwise the limb is distorted by the action of the muscles. The time during which the apparatus is to remain on, will depend upon the state of the fracture, upon the size of the bone, upon the power of the surrounding muscles, and upon the function of the limb. In fractures of the lower limbs it should always remain on longer than in those of the upper; in oblique longer than in transverse fractures. If at the proper time no firm callus be formed, the causes which prevent its hardening (*par.* 579) must be removed. General diseases require suitable treatment; the ends of the broken bone must be kept in the closest contact and at rest; the apparatus must be applied less tightly on the seat of fracture, and generous strengthening diet ordered. Many months may elapse before the callus becomes quite firm.

[(1) As a fracture should never be properly put up till all swelling have ceased, and the soft parts have almost entirely, if not completely, returned to their natural size, it is unadvisable to continue the use of any cold applications of any kind. It is better to leave the limb entirely alone as long as possible. On the upper limbs the bandages rarely require readjustment for ten days or a fortnight; and on the lower limbs, not for a fortnight or three weeks. Though it must not be forgotten, that one or other strap may require a little tightening daily for the first three or four days, till its woof have attained its utmost stretching; but it is rare that the whole apparatus needs re-adjustment before the time just mentioned. I have, indeed, often known the whole apparatus, bandages and all, untouched from their application till their removal, with the best results.—J. F. S.]

587. The earlier and more perfect the setting of the fracture is, the fewer symptoms follow; but if before the setting be effected, much inflammation and swelling have taken place at the seat of fracture, the patient must be prepared by suitable blood-lettings and dispersing applications for the setting, in which the limb is to have such position that all the muscles shall be properly relaxed, and, if possible, extension and counter-extension made above the neighbouring joints, by which the muscles passing over the fracture are not pressed and dragged by the hands of the assistants. The setting must not, under these circumstances, be long delayed, for the principal mode of diminishing the inflammation is setting the fracture, the ends of which then no longer irritate the soft parts.

Many moderns comply with the general maxims heretofore followed by the older Surgeons in reference to setting and to the application of apparatus after from the first four to eight days, to allow and to wait for the passing by of the inflammation, till the pain and swelling have diminished, and thereby a more secure position of the limb obtained. This advice is manifestly objectionable, and the putting off the setting to be restricted only to those cases where decided inflammation has set in.

[As a general rule, I do not at all agree with the principles here laid down by Chelius; I am quite certain that no fractures, excepting those of the collar-bone, and very oblique fractures, in which the ends of the bone threaten to penetrate the skin, should ever be set, that is, put in splints and bandaged, till after three or more days, or more correctly speaking, till the swelling has ceased and nearly or completely subsided. Nothing is gained by immediate application of splints and bandages, for the increasing swelling renders the latter so tight that they require loosening, in consequence of the severity of the pain caused by the constriction; and I have known mortification ensue from this cause, and amputation required to save the patient's life; and after this necessary relaxation of the bandages, when the swelling subsides, the whole apparatus becomes loose and useless, and requires to be re-adjusted. Therefore all that should be done at first is, to lay the limb upon a pillow, in a position which gives the patient the greatest ease, and soothes the irritability of the muscles; for which purpose a position intermediate to flexion and extension should be preferred; and in reference to the upper limb especially, such as will facilitate the return of the blood from its extremity, namely, raising the hand and elbow above the shoulder. A piece of linen moistened with an evaporating lotion is commonly laid over the limb, and may, perhaps, tend to diminish the effusion, and check the action of the vessels of the part; but if there be not much disposition to swelling or pain, it is of little consequence, except to satisfy the patient's mind that something is being done for his relief. Generally, bleeding in town practice is totally inadmissible, and I much doubt its needfulness under any circumstances. Local bleeding with leeches is now and then required, but in general rarely called for, and I think best left alone; for after the lapse of a few days all the powers of the constitution, and of the part itself especially, are required for the reparation of the injury, and therefore should not be uselessly diminished.

In cases of fractured collar-bone, or of oblique fractures, something must be done at once, to counteract the muscular contraction, which tends to thrust the bone among the muscles or against the skin, and even to pierce it. But even under these circumstances, the object is not to set the fracture, but simply to quiet the muscles, and to arrest the irritation they excite by their continual forcing the ends of the fracture into themselves, and thereby increasing the disposition to that unsatisfactory proceeding, and worrying the patient's feelings. In these cases, therefore, extension should be employed, as CHELIUS advises; but nothing in the way of setting the fracture should be attempted till the swelling have subsided. Sometimes in oblique fracture position will be sufficient to allay these inconveniences without extension, but not always the same position. Two persons may seem to have a precisely similar oblique fracture, but in one the spasm will only be checked by the straight posture of the limb, whilst in the other this can only be effected if the limb be bent. The decision of these points must depend on the circumstances of each case, and upon the judgment of the Surgeon, but they are of the greatest importance to the patient, and must not on any account be overlooked.

In the employment of extension, any special apparatus is rarely required. A bandage fastened around the joint below the fracture, with a weight attached to its end and slung over the side or foot of the bed, is usually sufficient. Nor is a very heavy weight requisite; three or four pounds, or a brick, is amply sufficient for the purpose, as after a few hours the muscles soon tire of dragging at even so slight a weight, and, ceasing to act, no longer force the fractured ends of the bone into themselves, and the fracture drops into place.

Should the bowels be loaded, it is advisable that they should be cleared by a gentle dose of castor oil before the fracture is set. But when the setting has been perfected, it is best that they should be unmoved for several days, so that the fracture may not be disturbed by the patient's movements. If, however, he should become uneasy and feverish, they must be looked to, and relieved with as little disturbance of the limb as possible.—J. F. S.]

588. Little important as are the symptoms which generally occur in Simple Fractures, yet may they be very serious in Compound Fractures (1).

If considerable bruising or division of the soft parts be connected with fracture, the inflammation is always very great, and requires strict antiphlogistic treatment, blood-letting, leeches (2), cold applications, and so on, together with the simultaneous use of opium, if very severe pain and other nervous symptoms be present (3). In very great swelling and tension soothing applications should be employed (4).

The wounds accompanying fractures are either consequent on the external violence, or on the bony pieces being driven through the soft parts. In the former case the setting is usually not connected with any particular difficulty, and the wound may be brought together with sticking plaster, even although its state be such as to give little expectation of its being followed by quick union. In the latter case the difficulty of setting depends on the size of the wound, and on the projection of the pieces of bones, as well as on their direction. The wound is to be enlarged, if the piece of bone be firmly girt by it (5); the extension is always to be made in the direction of the protruded bone, till the broken ends no longer overlap, and then the limb is to be put in its straight position. If the fracture cannot be set in this way, it is necessary to saw off the protruding pieces of bone (6). Splinters, if quite loose, must be removed; those which still remain attached must be pressed into their place, and they should only be removed if they produce inflammatory nervous symptoms or abscesses (7). If the wound suppurate it requires, should the suppuration be slight, the usual treatment; if it be more copious, care must be taken for the free outlet of the pus either by sufficient enlargement of the wound or incisions, and by suitable position of the limb every collection and burrowing of the pus must be prevented. If, during suppuration, splinters become loose, they must be dextrously removed; the dressings must be renewed as often as the quantity of pus renders it necessary (8).

Injuries of large vessels in open wounds are of little consequence, as they may be tied, either at once, or after enlarging the wound. Deeper-seated vessels are generally injured by the ends of the bones, and the blood collects in the cellular interspaces of the limb. In this case the wounded vessel, or if that be not possible, the trunk of the artery above the wound should be laid bare by a proper incision and tied (9).

Mortification may take place, either as a consequence of a high degree of inflammation, or of the weakly constitution of the patient, or from severe bruising and tearing of parts, from very great violence employed in setting the fracture, or from too tight bandaging. Sometimes therefore a strict antiphlogistic treatment must be employed, and every irritant and pressure removed. Sometimes strengthening remedies internally and externally must be used. Opium is frequently of most important service (10).

In *delirium nervosum tremens*, which occurs particularly in old persons, in drunkards, also in great corporeal irritability, from mental emotions, severe pain and so on, generally two or three days after the accident, but often later, during suppuration with restlessness, confused ideas, talkativeness, screaming, raging, insensibility to pain, sleeplessness, with weak or small, soft or quickened pulse, opium must be given in large doses till the patient is kept constantly asleep; only in great determination of blood to the head may careful blood-letting, leeches to the temples, mustard poultices, and so on, be previously necessary. I have always noticed the best effects from opium; not so however from tartar emetic in divided doses, assafœtida, valerian, which have been recommended by different persons for this disease. Spirituous liquours must not be withdrawn entirely from drunkards during this treatment. If sleep do not take place, death is the consequence. On dissection no disease is found (DUPUYTREN); frequently there is exudation on the arachnoid, pus in the joints, and in the sheaths of the tendons (JÆGER).

[(1) In the consideration of compound fracture it must be carefully remembered that the existence of *a large wound with fractured bone does not constitute a compound fracture*, but that a fracture is *only compound when a wound, however small, communicates with it, so as to expose the broken bone to the air.* A fracture with a wound may, however, become in a shorter or longer period compound, by this communication being established. And even a simple fracture, where the soft parts are very thin above the broken bone, or where they are much bruised, may, and often does in the course of two or three days, become compound; or the same result may be produced in simple fractures, (especially if the bone be broken obliquely,) either by spasm of the muscles, or by the patient's restlessness thrusting the broken end of the bone through the skin, almost immediately after the accident, of which I have seen instances, and one from the latter cause but very lately.—J. F. S.

"Compound differ from simple fractures," observes JOHN HUNTER, "in the first and second modes of union being lost; and, therefore, the third, by granulation, takes place. The granulations between the ends of the bone and on the lacerated surfaces take on an ossific disposition, and the suppuration is always more or less surrounded by the adhesive inflammation, so that it extends pretty far, and consequently the callus is large.

Hence these fractures are so tedious and dangerous, especially when in the lower extremity, which is their usual situation. There are no bounds to the mischief done by a compound fracture; the loss of the uniting substance by the wound, and the loss of the living principle to what remains by the exposure, are causes of the failure of the first process, and besides, the ends of the bone are sometimes so locked together, as to require to be sawed off, or so denuded of their investing membrane, as to lose their living principle, and to exfoliate, as the dead part must be thrown off before the wound can heal. This sometimes takes six or eight months, and is so extensive, as to be very dangerous. The inflammation too which follows the accident is commonly very considerable, and may proceed to mortification." (pp. 508, 9.)

ASTLEY COOPER says:—"The effect which compound fracture produces on the constitution is to set up a violent re-action, so as to bring about a restoration of the injured part. The degree of this effort of the system will very much depend on the manner in which the accident is treated; and I should say that it was an important injury or otherwise, according to the plan of treatment which is pursued; for if you are careful in the management of the case, you may procure adhesion of the external wound, and thus reduce the accident to the state of a simple fracture." (p. 644.)

The truth of these observations is fully confirmed by even the most limited experience; and it may be worth mentioning, as confirmation of the propriety of attempting to unite the wound, and so to produce a simple fracture, that MIESCHER found difficulty, in experimenting upon rabbits, to produce suppuration in a compound fracture. "I broke," says he, "the shin-bone of a rabbit in the usual way, and by cutting into the soft parts, down to the fracture, endeavoured to excite suppuration, but the wound covered with a scab, was shortly closed, and the fracture united by adhesion. I then thrust the end of one of the fragments through an artificial wound; this, however, failed of exciting such suppuration as I wished, the projecting part ran into necrosis, and was afterwards thrown off, but the lips of the external wound girt tightly around it, were covered with a crust, and the cure went on within just as in simple fracture. At length I succeeded according to my wishes, by thrusting a small pencil of charpie through the external wound down to the fracture, and there leaving it." (p. 219.)

(2) If in simple fracture general blood-letting, or even leeches be rarely expedient, in compound fracture, at least in towns, they should never be resorted to, for patients living in such districts have not sufficient constitutional power to admit of its diminution in the long run, although it might seem requisite at the onset. In country practice, however, where the people are more generally healthy, and less addicted to the abuse of spirits or malt liquor, general bleeding is sometimes required, but should always be resorted to only upon the most careful consideration of the case.

(3) As regards opium, in healthy persons, it is better not to administer it, as by affecting the head, its common effect, it masks the symptoms of constitutional disturbance, and renders them apparently more severe than they really are. If, however, the patient be of drunken habit, and there be reason to anticipate an attack of *delirium tremens*, then opium must be resorted to as an absolutely necessary part of the treatment.

(4) I always prefer poultices of warm bread and water, as a tepid evaporant, according to ABERNETHY's method, rather than cold applications, because they relieve the tension of the skin, lessen the inflammatory disposition, do not retard quick union, if the wound be disposed to it, and encourage the separation of sloughs, and the production of healthy granulations, if the skin be so injured as not to unite by adhesion.

(5) Enlargement of the wound in compound fracture should not be lightly undertaken, and as far as my experience goes, is not often requisite; for if the Surgeon have a little patience and dexterity, a protruding fracture may often be coaxed, if the expression may be permitted, to recede into its place, when force is quite unavailing. Should it, however, be necessary to enlarge the wound, the operator should carefully select such part of it as with least division will permit the return of the bone.

(6) Sawing off the protruding portion of the fracture is still less necessary than enlargement of the wound, and should never be resorted to but on the most urgent necessity. I believe that in but exceedingly few instances its needfulness depends rather upon the incapable conduct of the medical attendant than on the nature of the accident itself.

(7) Loose pieces of bone, if not of large size, but lying between the main parts of the fracture and near the surface, especially if the wound be large and there be much bruising, are best removed at once, as they rarely unite, and commonly keep up irritation till they are thrown off; not unfrequently also they prevent the union of the main pieces, and render amputation necessary.

(8) During the progress of compound fractures, abscesses often occur, sometimes near to, sometimes more distant from, the wound. If after a few days they do not make their way to the wound, and empty themselves by it, or if after having so done, they burrow beneath the skin, it is best to puncture them, to favour the ready escape of the matter; but large wounds for this purpose are neither necessary nor advisable.

(9) Wounds of large vessels in compound fracture are not of so little consequence as CHELIUS thinks; nor is either tying them in the wound, or tying the trunk above, so lightly to be undertaken as his recommendation would seem to infer. Active arterial bleeding in compound fracture is always a very important circumstance, and requires grave consideration as to the treatment to be adopted. The first point to be determined is the possibility or propriety of taking up the vessel in the wound. If the bleeding orifice be exposed, the vessel may be tied above and below the wound, if it be only wounded; but if it be torn through, both ends should, if possible, be tied, as unless that be done there is no certainty that bleeding will not recur from the untied end at any time that the general wound be unhealed. If the vessel cannot be found by carefully and gently sponging out the wound, then comes the question, should the wound be enlarged in the direction presumed most likely to discover it? I think not, as it is commonly a very uncertain and unsatisfactory proceeding, the torn state of the parts, and the effusion into them, rendering the discovery of the vessel very difficult and often impossible; besides which, the bleeding vessel may be almost certainly ascertained to be so deeply situated and so lodged, that it cannot be got at from the wound, even though enlarged, as when the posterior tibial or the peroneal artery is injured, and the wound is on the front of the leg. The second point then presents itself, that of tying the principal vessel of the limb above, and at a distance from the wound. This is open to two objections, first, that there is no certainty of the bleeding not recurring when the circulation has been restored by the collateral branches, under which circumstances the patient is again placed in the same dangerous condition as originally; second, that there is always fear of the limb becoming gangrenous from the supply of blood having been cut off, under which state the patient's recovery can only be hoped for by having recourse to amputation whilst in a most unfavourable condition.

With these views, it seems to me preferable, if the bleeding cannot be stopped by taking up the vessel in the wound without much disturbance of the injured part, to amputate the limb at once, as being the safest course to pursue; for if there be much groping in the wound, it will most assuredly slough, and the patient suffer severely from, if not be destroyed, by the consequent constitutional irritation.

(10) Mortification may occur at almost any period after compound fracture, and when setting in early, most commonly depends on the severity of the bruising and tearing, which the constitution feeling it has not power to repair, makes no effort towards restoration, but immediately sets about throwing it off. If there be sufficient strength, the extent of the slough is soon defined by the ulcerative inflammation, which forms a groove, at first superficial, and then gradually deepening and following the dead parts till their final separation. Sometimes, however, the sloughing commences below, and the skin remains for a time sound, until the pressure of the slough and pus, with which it is sodden, causes ulceration for its discharge. At other times the mortification remains undefined, and from day to day continues creeping on till the powers of the constitution are worn out, and the patient sinks from the accompanying hectic fever.

The constitutional treatment is, in these cases, of the first importance; not loading the stomach with medicine, but judiciously providing it with easily digestible and nutritious diet: strong beef tea with arrow-root, blanc manger, jelly without acid, eggs, and oysters if in season; the latter I have often induced patients to take when nothing else would be taken. The patient's habits in regard to beer, wine, or spirits, are to be carefully inquired into, for that quantity of either which, with moderate persons, would be considered large, is to others of not the least benefit. I have known a pint of brandy taken in the course of the day, and absolutely necessary to carry a porter through safely whose leg had been amputated for compound fracture. A pint of wine, or four or six ounces of brandy, or three or four pints of beer, or portions of all three, are commonly required in our treatment of these cases in the hospital. Sometimes it is necessary to give gin or rum, to which the patient has been accustomed, and which suit him better than any thing else. If the stomach will bear it, I prefer good porter far before wine or spirits; the effect of the latter are scarcely more than stimulating; but the porter is less stimulating, its effect more enduring, and the large quantity of mucilage it contains renders it at once both victuals and drink, and affords much nutriment to the constitution. If purging come on, the porter must be omitted, and brandy in arrow-root must supply its place.

As to external applications, simple bread-and-water, or linseed-meal poultices are best

when mortification has come on; and if there be offensive smell, a cloth dipped into solution of chlorate of soda may be put next the wound.—J. F. S.]

589. To keep the limb at perfect rest and firm after properly setting the fracture, and to prevent, at every readjustment of the apparatus, the easy occurrence of motion and displacement of the ends of the bones, various means have been proposed, which when once applied are to remain till the cure be perfected.

Larrey (*a*) describes the following as the best treatment for compound (as well as for simple) fractures. After enlarging the wound if necessary, the effused blood is, as far as possible, to be squeezed out, any wounded vessel tied, and the setting adjusted, the edges of the wound are to be brought together, and steadied with some perforated strips of linen spread with *ung. styracis,* and with soft charpie and compresses overspread with a glutinous tonic liquor, as wine or camphorated acid, mixed with white of egg. These compresses must surround the whole limb so closely that not the least space is to be left between them, and so that they should produce equal pressure on all sides; the usual splints may be profitably applied. After the application of a sufficient number of compresses the eighteen-tailed bandage (which is preferable to Scultetus's) should be put on. This dressing must be reapplied once or twice before the completion of the cure, and the secretion of the wound which has filtered through must be removed with a sponge. This treatment has the advantage of preventing the frequent and always dangerous movements which occur in the often necessary renewal of the ordinary contentive apparatus. But we obtain the same advantage from the use of the contrivance subsequently to be described, for permanent extension, by which also the injury is prevented arising from retention of the secretion of the wound and loosened splinters of bone, especially at a hot time of year. This mode of treatment, viz., the undisturbed application of the apparatus, is common with the Spanish military Surgeons, and may be also employed in gun-shot wounds (*b*), and so on. Corresponding to this is the plaster of Paris apparatus, with which the whole broken limb is enveloped, and as it becomes firm it serves instead of splints and every kind of bandage; and by making apertures, either at first or subsequently, in the hardened mass, the wounds and so on can be attended to (*c*).

Seutin (*d*) envelopes the whole limb in the ordinary way with Scultetus's bandage, which he smears with starch paste, then applies a second Scultetus's bandage over it, and repeats the starching; two pasteboard splints softened in warm water and also smeared with starch are laid on both sides of the leg, and fastened with a third Scultetus's bandage, which is also smeared over with starch. In fractures of the upper extremity, the limb is to be surrounded with a circular bandage smeared with starch, over which softened pasteboard splints are applied, which are to be fastened with another circular bandage, and this again smeared with starch. When his apparatus has dried, it becomes so firm that the broken ends of the bone cannot be displaced by the motions of the limb, which even the patient himself can move from time to time; in fractures of the lower limbs he can, after some time, even walk with the apparatus. The apparatus must always be applied before much swelling comes on, and with the greatest accuracy, the particulars of which will be given in the several fractures.

[Some Surgeons have great preference for the several fracture-apparatus of Amesbury (*e*), the general principle of which in those for the lower limbs is to make one part of the limb form a point of resistance from whence extension can be made and kept up at the opposite end without other aid than the machine itself. This having been done so

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(*a*) Mémoire sur une nouvelle manière de réduire ou de traiter les Fractures des Membres compliqués de Plaies; in the Journal Complémentaire du Dictionnaire des Sciences Médicales, January, 1825, p. 193.

Larrey, F. H., Traitement des Fractures des Membres par l'Appareil inamovible. Paris, 1842. 4to.

Koch, L., Ueber Behandlung mit Wunden complicirter Knochenbrüche; in Journal von Graefe u. Walther, vol. xiii. p. 564.

Balling, uber Complicirte Fracturen; ib. vol. xiv. p. 1.

(*b*) Roche et Sanson, Elémens de Pathologie Medico-Chirurgicale. 2nd Edit., vol. iii. p. 422.

Eton, W., A Survey of the Turkish Empire; in which are considered its government, the state of the provinces, the causes of the decline of Turkey, and the British commerce with Turkey, &c. London, 1798–9. 8vo.

Melier, in the Journal Général de Médecine, December, 1828, p. 341.

(*c*) Muttray, J. A., Dissert. de Cruribus fractis gypso liquefacto curandis. Berol., 1831. 8vo.

Richter, A. L., Abhandlungen aus dem Gebiete der prakt. Medicin und Chirurgie, Berlin, 1832, p. 1.

(*d*) Mémoire sur le Bandage Inamovible. Bruxelles, 1836.

Berard; in Archives Générales de Médecine, 1833, June, p. 218.

Rognetta; in the Gazette Médicale de Paris, 1834, April, No. 17.

(*e*) Practical Remarks on the Nature and Treatment of Fractures, &c., 2 vols. 8vo. London, 1831.

as to bring the fractured ends of the bone into proper place, the splints attached to the apparatus are adjusted to the limb, and having been properly fastened, there is little possibility of displacement from whatever posture may be chosen to put the limb in. In the apparatus for the upper limb, the weight of the arm principally keeps up the extension; but the steadiness of the fracture is especially provided for by an angular splint applied in front of both upper and fore-arm. These contrivances are very effective in the treatment of fractures, and will occasionally be advantageous when most other attempts fail; but I think they are objectionable on account of their complicity, which requires especial instruction to understand, so as to apply them properly; for otherwise they are not merely useless, but injurious, by the unequal and misplaced pressure they produce, the result of which very commonly is, tiresome sores; and for their cure it is often necessary to free the limb entirely from any apparatus. They have also the inconvenience, especially those for the lower limbs, of rarely being capable of proper adjustment, on acount of the variety of people's size, to more than two or three persons; and hence at least half-a-dozen sets of various length should be always at hand, which in country practice cannot be expected, where also there is little probability of properly repairing the apparatus, in case of breaking or disarrangement.

I must confess that I consider the more simple are the means employed for treating either simple or compound fracture the better. The starched and gummed bandages have rendered this part of surgical practice as simple as it is efficient; but if the Surgeon prefer wooden splints, he can always readily furnish himself, with or without the aid of a carpenter, with pieces of deal about three inches wide and the sixth of an inch thick, which he can cut to the requisite length for the limb on which the splints are to be applied. These together with pads and bandages are sufficient for the treatment of almost every fracture, either simple or compound; for the Surgeon will do well to remember that the well-doing of the case depends rather on the way in which he adjusts the apparatus, of whatever kind it may be, than on the gimcrackery with which some mechanical Surgeons are fond of furnishing it.—J. F. S.]

[589.* After the protruding ends of the fractured bone have been drawn back, so far as possible, into their natural place, the choice of position in which the limb should be put, is the next point for determination. To this the Surgeon is directed by the situation of the wound, it being necessary that the limb should be placed, if possible, so that the daily or more frequent dressings may be effected without its being disturbed; but if, as sometimes happens, this cannot be avoided, that the position should be such as should permit dressing with least movement. Practical experience can alone specially guide the Surgeon as to the best mode of effecting this object; but the general rule is, so to place the limb that if suppuration be expected, the pus may have the opportunity of escaping as it is secreted from the wound, and not the probability of burrowing, which materially interferes with the cure, and wastes the constitutional powers, by the irritation it keeps up. The choice of the apparatus to be employed in the treatment of the case must also, in many instances, materially depend upon the seat and extent of the wound; for though the practitioner may have a preference for one kind over another, he will be much disappointed if he expect that one apparatus and one position is suitable on all occasions.

Having determined the position, and prepared the apparatus which he has selected, the fracture is immediately to be put up; and this, it will be observed, is a very remarkable difference from the treatment recommended in simple fracture. But in compound fracture, the swelling, if it at all occur, is but slight, as the serous part of the blood readily escapes by the wound, and more readily if the wound be large, so that there is little or no fear of mischief from the increase of the swelling tightening the bandages and causing the inconvenient squeezing of the limb, which happens in simple fracture, if the apparatus be immediately put on. The great object in compound fracture is to render it, as soon as possible, simple, by healing the external wound, and this can only be effected by steadying the broken bone, as well as the soft parts, by the immediate application of the apparatus; which done, the limb is to be put into the position determined on, and so propped by pillows, or fixed by bandages to convenient parts of the bedstead, that all motion should be guarded against. The wound now alone remains to be dressed; and **Astley Cooper** says:—"If there be a slight hæmorrhage, do not be searching for a small vessel, but place a little lint over the wound, and by making gentle pressure on it you may easily suppress the hæmorrhage. Next bring the integuments as neatly over the parts as you can, and dip a dossil of lint in the blood and put it on the surface of the wound, which irritates the least of any application I know of, and appears to approach the nearest of any other to the natural covering of the parts. In this way the wound unites by the adhesive process, and the union of the bone goes on as in simple fracture, and is cured in one-fourth part of the time which would be required if the wound were allowed to be filled by granulations." (p. 646.) I must confess I prefer some slips of sticking plaster to the dossil of lint over the wound, for as it rarely happens that the surface of the wound immediately unites by adhesion, although the parts below may, the oozing serum, or the pus which speedily forms, is confined under the hard crust of the lint, and certainly produces a sore, which will be deep, according to the quantity confined; whilst, on the other hand, the fluid soon manages to find its way out between the interstices of the plaster, and thus this inconvenience is avoided.

It is also advisable, in compound fracture, to cover the fractured limb with a piece of linen dipped in an evaporating lotion of spirits of wine, liquor of acetate of ammonia and water, a fourth of each of the former, and two-fourths of the latter; and the linen should be re-wetted by gently squeezing a sponge over it as often as it dries. For the more effectual cooling of the limb, a cradle should be put over it, over which merely a sheet is to be thrown. And this is no trifling part of the treatment, for if, as not unfrequently happens, a heap of bed-clothes be put upon the cradle, on the plea of the patient feeling cold, all evaporation is put a stop to, the limb is put in a steam-bath, and might as well be wrapped up in a poultice. The patient's feelings as to temperature should not be overlooked; the body and other limbs should be covered so as to render him comfortably warm, but the injured limb must only have the cradle and a single sheet.

Even if the wound in the skin be torn and its edges shreddy, a condition far from uncommon, it is always best to attempt its union by adhesion, for though the whole may not unite, very commonly a large portion of it will, and the danger of the injury will be proportionally diminished.

But if the wound be much bruised, together with the tearing, there is little hope of union by adhesion, and therefore either a poultice alone should be at once applied, or two or three adhesive straps far apart and a poultice over them, which must be changed three or four times a day.

In those cases where adhesion is attempted, the dressings should not be removed unless the patient complain of pain in the wound, either accompanied or not with surrounding inflammation. If the case go on well, there is rarely uneasiness till after four or five days; the dressings should then be removed, after having been moistened by the application of a wet poultice for a few hours; and according to the appearance of the wound, it must then be determined whether adhesive plaster is to be continued or poultice applied, which latter is necessary if the wound look angry and sloughy, and must be continued till it shall have become quiet and suppurate kindly, when it may be dressed either with plaster or ointment as may seem most suitable. I have, however, often known the wound unite at once, without a second dressing being needed.

I need scarcely observe, that the Surgeon, in the treatment of this injury, should most carefully avoid meddling or prying into what is going on, unless the patient complain of uneasiness or pain. He should attentively watch from day to day, that the limb retain generally the position in which it was placed; and if it have become materially displaced, it must be put to rights with the greatest tenderness and care, and such additional precautions taken as to prevent a recurrence. Especial inquiry should also be daily made as to the fitting of the apparatus, so as to guard against any digging in of the edge or corner of a splint or any other part of the apparatus; and if such have commenced, to relieve it, partially loosening the straps so as to insinuate gently with a spatula or probe some lint, wadding, or soft linen. Inattention to this point is often followed by tiresome sores, requiring sometimes the complete removal of the apparatus, which disturbs the progress of the cure, or even, as I have seen, causes the loss of the limb, and even of life.

It must, however, always be remembered, that the great maxim in the treatment of compound fracture is, "to leave well alone," instead of attempting to do better.—J. F. S.

"The only peculiarity in compound fracture," says JOHN HUNTER, "by which it differs from other lacerated wounds, is the breach of continuity of the bone, which admits of motion in the part where none was intended. This singularity it is which requires a peculiarity in the treatment, as this motion and the operations of nature are in contradiction to each other. A variety of inventions have been employed to prevent this motion; but the dressing of the wound every day counteracts the effect of every invention that has been thought of, and it is perhaps impossible to dress the sore without motion. [Since HUNTER's time, as has just been shown, many very efficient contrivances have been hit upon, by which this inconvenience, or rather actual ill, is avoided.—J. F. S.] At first the part is generally put into a poultice; but changing this must give considerable movement. Instead of a poultice, I would lay the leg or arm in cloths, doubled several times, and wetted with goulard, and lap them over so as to come into contact. These should be wetted occasionally, and continued until the inflammation is over and the suppuration takes place * * * The time of union of a compound fracture is necessarily much longer than that of a simple fracture, from the processes they have to go through, and is very uncertain; but the union of the bones is generally effected long before the external wound is healed up, for whatever retards the cure of the bone retards also the cure of the sore. When granulations have been formed, and bony union is late in taking place, and the wound is healed up, or nearly so, it should be treated like a simple fracture in the same circumstances, and gentle pressure is of use, as walking, with a machine to take off the weight of the body; here necessity acts as a stimulus for bony union to form.

"Compound fractures do not always take on the bony union; but there is never a want of soft union, as there is at times in simple fractures, and therefore new joints are never formed, as they are sometimes when simple fractures do not unite by the first or second modes of union." (p. 509.)

With regard to the union of compound fractures, ASTLEY COOPER observes:—"The mode of union is ultimately the same, but in the one kind of injury ossific matter is deposited in cartilage, *without* a suppurative process, and in the other with it. If you do not procure an union by adhesion, it is brought about by granulation, and in the following way.

"The blood which is at first poured out, in consequence of the division of the vessels of the medullary membrane and the *periosteum*, instead of being confined in the surrounding structures, passes off by the external wound: yet it must be remembered that this effused blood has no share in producing union of the ends of the bone, as it becomes after a few days entirely absorbed. Next there is a fluid poured out between the *periosteum* and the bone which separates the *periosteum* from the surface of the bone, for about an inch or an inch and a half beyond the place where the bone is fractured. This fluid does not cause a laceration of the vessels of the *periosteum*, but rather an elongation of them. Now here is the difference between the simple and the compound fracture; for, in the former, the fluid, after accumulating for a day or two, becomes in a great measure taken up by the absorbents, and adhesive matter is poured out in its stead, but in the latter a suppurative process is established, and granulations arise from the broken surfaces. In these granulations cartilage becomes deposited, and continues to be formed for some time; the discharge of pus gradually diminishes, and in compound fracture cartilage continues to be formed until about the twentieth day. It is deposited between the internal surface of the *periosteum* and the external surface of the bone. At the place where the fractured ends are brought into contact, the *periosteum* becomes absorbed and cartilage is deposited between them, in which patches of bony matter are formed, and these, when completed, are covered by an extension of the original *periosteum*. * * * * Under the granulations arising from the cancellated structure cartilage is also found, and from the seventeenth to the twentieth day there are bony patches deposited in the cartilage. It is by the accumulation of these patches that ossific union gradually takes place. A compound fracture is necessarily slower in its progress towards recovery, from the causes just explained, than a simple fracture, and the union is frequently retarded by exfoliations of bone, which will often take up a tedious time to separate, and keep up considerable irritation. *Three months* may be considered a short time for the union of a compound fracture to take place; sometimes the accident is not recovered from in nine months, and occasionally not even in twelve." (p. 644-46.)

The following is the summary which MIESCHER gives of his experiments on rabbits to ascertain the processes under which suppurating fractures are united:—

"If the circumstances which occur in the progress of suppurating fractures be compared with those noticed in simple fractures, it will be seen that the mode and way of cure is precisely the same in both. The soft parts swell, coalesce, and together form a capsule around the fracture, from the internal surface of which, and from the *medulla*, although from the latter, according to circumstances, not always, a new substance proceeds, and when sprung from both, at length envelopes the several fragments untied together; whence it is self-evident that this is the same substance as that which I have called *intermediate*. At a subsequent period, as seen in the fourth experiment, this substance produces a sort of fibro-cellulous membrane, easily separable from the other soft parts, and comparable with the *periosteum*, which, in simple fractures, is presented as the recent investing callus; this, therefore, is the only difference, that in the fractures of which we are now speaking pus is formed, and the new substance at its commencement presents the appearance of granulations. The substance of the callus which fills up the medullary cavity is produced by simple exudation, as in simple fractures, and no less are the first fruits of the external callus, by which the *periosteum* still adheres to the bone, produced by simple exudation; but so soon as the callus has stretched beyond that part, the rest is formed by the granulations growing with a secretion of pus. Why all these formations should proceed more slowly is easily understood, from the circumstances generically connected with suppurative inflammation.

"However, there is this very great difference between the cure of simple and suppurating fractures, that in the latter the ends of the fragments are bared, and that the evolution of the later callus takes place on them; but in the third and fourth experiments there could be no doubt that the bared parts of the bone were dead, because very decided marks of incipient exfoliation existed; and in the other experiments, the white colour of the bone showed the presence of necrosis. On the one side only would there be necrosis, if the other, as it seemed, had not been at first deprived of *periosteum;* but the entire extremity of the fracture would be involved if the *periosteum* had been torn from its whole circumference. If the *medulla* remained healthy to the edges of the fracture, the necrosis would attack only the surface of the bone, but if the *medulla*, killed as it seemed by the violence of the inflammation, were destroyed throughout the whole bone, so far as the *medulla* was dead the necrosis would be seen. The splinters had arranged themselves; those which were entirely separated, were, as might be expected, not contained in the callus, but, on the contrary, still adhered by one part to the *periosteum*, new bony substance proceeded from them, and that surface of them towards the cavity filled with pus, was alone dead, just as the bared ends of the fragments.

"How the cure proceeded after the separation of the necrosis I am sorry I cannot from observation state, as my experiments were not continued sufficiently long; but what more is needed can be easily supplied from what has been elsewhere observed about necrosis. It would, however, happen, that after the dead part was separated and thrown off, the bone would be covered with granulations, which growing, would by degrees be converted into cartilaginous and bony substance, producing what I call the SECONDARY CALLUS, and at length be united with the parts in the immediate neighbourhood.

"But this very point, that the parts of the fragments bared of *periosteum* pass into necrosis seems to be greatly impeached, because practical Surgery in suppurating fractures should propound that the prognosis is bad from the first; for although I would pass over that in such fractures the first callus proceeds much more slowly, and consequently that arising on both fragments does not so readily unite, the latter callus which is the principal cause of the fragments uniting firmly together, is completely unbegun until necrosis has ceased. But this separation is often effected too late; the formation of the soft parts of the intermediate substance, as it were proceeds more and more, whilst the necrosis ceases to be separated, and between the extremities forms dense membranous investments, pretty closely enveloping the broken ends, as seen in the fourth experiment. The exfoliation being completed the granulations at length spring up, and shortly coalesce with these investments: the inflammation, inasmuch as it has been kept up by the necrosis alone, soon ceases, and cicatrization takes place; therefore not only is there a loss of the substance, but even that by which the lost substance of the bone is repaired, is removed. Hence either the bony junction of the fragments is effected by the first callus alone, and therefore the union is little firm; or the fragments are merely contained in fibro-cellulous investments, and a *spurious* joint, as it is called, is formed.

"From the fewer experiments I have made, I certainly dare not conclude that the parts of fragments bared of *periosteum*, inasmuch as they are bathed in pus, always die, and that the doctrine advanced by GENDRIN, that "these parts are softened, changed into red tissue, and covered with granulations," is entirely refuted; for what is alleged by this writer from experiments, so far as may be judged from the manner of his narration, seems no less to be depended on, although he has not stated what the experiments were. Besides, my experiments on full-grown rabbits were not sufficiently numerous, that any thing could always be certainly collected from them. But they so agreed together, as also entirely with those which I have elsewhere noticed of acute inflammation of bone, that I cannot but at present rather doubt, that softening and swelling, which almost every one agrees existing in inflamed bones, and hence I am disposed hereafter to follow this matter further.

"It is doubtless very remarkable that GENDRIN, BRESCHET, MEDING, and KORTUM, make not the least mention of the necrosis which exists in suppurating fractures. MARRIGUES (*a*) had distinctly stated that the first callus could not be produced in suppurating fractures of bones, as the extremities of the fragments, if not entirely, at least the greatest part of them exfoliated. Most other writers speak only incidentally and without clearness on this point; thus for example BELL says large portions of bone separate, BOYER that granulations spring from the ends of the fragments, sometimes whilst exfoliation proceeds, and sometimes when it does not. In observations relating to the cure of compound fractures, in the Surgical Journals edited by RICHTER, LANGENBECH, GRAËFE and WALTHER, I have at present found few in which it is not stated, that single splinters, and often indeed long after the occurrence of the fracture, are thrown off; in most I have found distinct mention of separated necroses, nor did it seem doubtful but that the splinters also above mentioned should be referred to the necrosis. It follows that necrosis exists in suppurating fractures, if not always and necessarily, yet doubtless in the greater number. But indeed since necrosis itself is to be considered the main cause why compound fractures are either but little firm, or entirely unconsolidated, and the necrosis arises not so much from the injury (mechanical) of the bone itself as from the disturbance of the first intention, is it not worth while to try whether, often by uniting the external wound, and converting the compound into simple fracture, which spontaneously happens in rabbits by the formation of a scab, care might not be taken that the bone should not die? Whether by a proper treatment the prominent parts of the bone having been accurately adjusted, or as circumstances might require cut off with a saw, the lips of the wound united, and more violent inflammation prevented, that may not be effected by art in man which in certain animals is done by nature?" (p. 223–25.)]

590. Amputation may be necessary in Fracture of Bones; 1, ***on ac-***

(*a*) Cited at the head of the Article.

count of the severity of the injury, if the bone be broken into many pieces, if the muscles, tendons, ligaments, nerves, and important vessels be injured, the joint-ends of the bone split, and the ligaments of the joint destroyed, so that mortification may be predicted with certainty; 2, *for mortification;* and, 3, *because of profuse suppuration,* which exhausts the powers of the patient.

[Of the three conditions, mentioned by CHELIUS, under which amputation is necessary in Compound Fracture, it must be remembered that although the decision on all requires great attention and practical experience, yet the first is most important, as it involves the question of *immediate amputation,* a point upon which Surgeons do not agree, but which is of the utmost importance to the patient. To prove the fact of this difference of opinion I quote the opinions of the two first Surgeons of our time, ASTLEY COOPER and JOHN ABERNETHY, at whose feet the greater number of English Surgeons of twenty years' practice have had the privilege to sit, and whose opinions, as the most distinguished disciples of the school of JOHN HUNTER, have largely contributed to the formation of, and still continue more or less to influence the practice of Surgery throughout Great Britain.

ASTLEY COOPER, after enumerating the various conditions of compound fracture which require amputation, says:—"If it will be necessary to amputate in a few days after the accident, then the sooner it is done the better. If you amputate at one hour after the accident, the patient will do better than if you leave it twelve hours. For this reason; if you amputate immediately, the constitution has but one shock to sustain, and in general rallies much better than when the amputation is delayed; but if you leave it eight or twelve hours there is a great degree of irritation previously set up. The loss of blood is rather a favourable circumstance than otherwise to precede the operation. The persons in whom these operations succeed the least are such as are loaded with adipose matter; if you leave the limb, the constitutional irritation runs so high that it generally destroys life, and if you amputate they frequently die in twenty-four hours after the operation from the constitution being unable to bear the shock which that operation produces." (p. 680.)

ABERNETHY was decidedly averse to immediate amputation, and was accustomed to state his opinion on this point, in his own peculiar manner (*a*):—"If there is much injury, sloughing will come on, and we must then consider whether the patient can have his limbs saved, or whether amputation is required. And then we are in an awkward predicament; but I have no fear that Surgeons will be in a hurry to cut off limbs; they recollect that people will talk of it, and say, "I wish —— had been under my Surgeon, he would have saved, or at least endeavoured to save his limb," so that self-interest will make Surgeons attentive as possible to preserve limbs. In Surgery we must do as we would be done by, and then we shall be acquitted at the grand tribunal. I should be very shy of amputating, because I have seen many cases which, though it was said they would not do well, recovered. Ask the old Surgeons, men who have seen much of hospital practice, and they will tell you that what I say is the case. I hold that if there is not much likelihood to inflammation or slough, we ought to give the patient a chance for the salvation of his limb. We have no warrant for lopping off parts of another person's body but for the preservation of the remainder, of the whole. * * * I am averse to sudden amputations, for there is a shock already imparted to the constitution by the accident, and another is given to it by the operation, and they often die of the amputation itself; but even if not, at any rate we have a tremendous story, the muscles retract, the bone sticks out and exfoliates, and the case is a discredit to you. There have been numbers of cases of compound fracture since I have been in this (St. Bartholomew's) Hospital, but they have all done well, except where amputation has been performed, not a single case had a good stump, and many died. Two men, however, who had their limbs broken did well. * * * It appears that in amputations those below the knee do worst, those in the thigh do better, and those of the arm best. Indeed I have no objection to amputating a lacerated hand or crushed elbow."

Such being the views of our most celebrated Surgeons, it must be allowed that it is no easy matter to lay down rules upon the important question under consideration, which cannot, on account of the improvement in the dietetic part of the practice of Surgery, if it may be so called, and to which, (although a most important part of the treatment,) till within the last few years, comparatively little attention had been paid, accord entirely with either teacher.

(*a*) MS. Lectures on Surgery.

The principal points to be considered in forming a *determination on the necessity, for no other reason can be admitted, of immediate amputation* in compound fracture, are:—1st, the nature and extent of the injury: 2ndly, the present condition of the patient, and his capability of bearing immediately the second severe shock of amputation: 3rdly, the consequences immediate and remote of compound fracture: 4thly, the advantage hoped for, by the immediate removal of the injured parts, in preference to the attempts at saving them.

1st. *Of the nature and extent of the injury.*—In examining a wound of the soft parts, the condition of the skin is to be especially looked to. If the wound in the skin be small, and the surrounding parts not much bruised, it is favourable; but if the wound be large and torn, if the skin be much stripped and accompanied with much bruising, it is unfavourable. If the bone do not protrude much, often, indeed, it does not protrude at all, and if it be not so tightly girt by the skin as to prevent its drawing back into its natural place, so much the better; but if it stick out considerably, and if it be so tightly grasped by the skin that it can only be drawn back with great difficulty, or not at all without dividing the tight skin, and not always then, so much the worse: but if the wound be cleanly cut, and do not oppose the return of the bone, I do not think it of very material consequence whether an inch of bone, more or less, be protruded. Thus far is ascertained with little or no interference with the injured part. But the next thing to be thought about is the depth of the wound, and the injury of the tissues contained within it. This is one of the most important parts of the point under consideration, and upon the proper conduct of which the patient's safety, and the probable success of any attempt to save the limb, will mainly depend. If meddlesome midwifery be most justly eschewed, meddlesome Surgery should be most utterly abhorred. The thrusting in of fingers, and poking about, for no other term is applicable, under the pretence of examining the depth of the wound and the condition of the fracture, is most improper, and ought most carefully to be refrained from. It matters not whether a wound be more or less deep; and if the Surgeon recollect the size of the bone and its natural relations to the soft parts, he can pretty well decide what the extent of the wound is beneath, and by a little gentle passing of the fingers over the skin in the neighbourhood of the wound, so that he inflicts scarcely any pain, he will be able to ascertain whether the fracture be comminuted or broken into many pieces; and he can do no more if he thrust his finger in and grope about, except that he will put his patient to much unnecessary pain, and increase his danger by disturbing the injured parts still more than already, and thus set up still more irritation, instead of endeavouring to soothe.

The proceedings of a Surgeon on such occasions, more, perhaps, than any other, show his greater or less knowledge of the principles of his profession. He may be an excellent operator, but unless he pay the most strict attention to points of practice like this, which are often too lightly considered, and risk the patient's well-doing, he is no Surgeon; and should have no credit for the well performance of an operation, the necessity for which has been caused by his own improper conduct at the onset of the case. He should recollect that, as has been often said, operations are the *opprobria* of Surgery, and should never be desired nor performed but when all other means have failed. These views were strongly impressed on my mind when a student, by the precepts and practice of my dear master, the younger CLINE, whose early death deprived our profession of a most highly-gifted member, and those who enjoyed his society of an amiable and kind-hearted friend. I gratefully acknowledge his able and continued professional advice and guidance in the early part of my career, and deeply grieve that he was not longer spared to increase the reputation of his distinguished family name, and to add to the high character of English Surgery.

If there be much tearing of the muscles and tendons, or of the tendinous covering of the limb, either or all of which are commonly seen by gently sponging the wound, there is great danger of *trismus* or *tetanus*, and amputation should be forthwith performed. The flow of blood from the wound, and the probability of a wounded artery, must enter into the consideration of the nature of the wound. Very frequently there is considerable loss of blood, but it must not be supposed that this always comes from an artery, or that even if it do, that the vessel needs tying. More commonly the bleeding is certainly only from the small muscular branches, and soon ceases. But it may and does occasionally happen that a large artery in the leg or fore-arm is wounded, pricked by the broken end of the bone or partially torn, in either of which cases it will continue to bleed; or it may, as I believe, be torn through, and, retracting, be plugged up by a clot in its mouth whilst the patient is faint, and at the same time compressed by the coagulation of the effused blood in its neighbourhood, and thus a hæmorrhage, violent at first, ceases spontaneously, without any very apparent cause. Often, though there has not been much bleeding before the fractured bone has been returned, yet almost immediately after a free oozing, or perhaps a stream of fluid will continue to escape for many hours, and only gradually subside after two or three days. This, however, must not be mistaken for blood, as by careful inspection it will be found only the serum escaping from the blood which has clotted below. But should it be undoubted, that the fluid is arterial blood, and if it flow in sufficient quantity, that after a few hours the circulation show itself considerably weakened, and the patient's condition be much depressed, then it is an unfavourable sign, and as I think, and have already mentioned, amputation should be performed in preference to disturbing the wound in search of the wounded vessel, which is often far distant from the part where the blood seems to come up, for the purpose of tying it, or in preference to cutting on the vessel and taking it up above the wound, because it will often bleed from the lower end, more or less readily, by the supply furnished from the anastomosing vessels, and because by cutting off the supply of blood, mortification of the parts below the ligature is very likely to follow, and require amputation when the patient is less able to bear it. For these reasons, in undoubted and free arterial bleeding I prefer immediate amputation.

2ndly. *Of the present condition of the patient, and his capability of bearing immediately the second severe shock of an amputation.*—The condition of a patient after compound fracture depends partly on his constitutional power, and partly on the severity of the injury. Much that has been already mentioned, (*par.* 335, *note* 3,) in treating of the *shock* in gun-shot wounds, is applicable here. Some persons will suffer a very severe compound fracture and be scarcely at all knocked down by it, whilst others with a comparatively slight one, will seem to sink without possibility of restoration, or will only revive with great attention and management after many hours. In the former case, if the Surgeon thought immediate amputation requisite, there would be no objection to its performance; but in the latter, even though the injury were very severe and accompanied with bleeding which could only be arrested by pressure on the great arterial trunk of the limb, the operation would, without doubt, destroy the patient during its performance, of which I have seen more than one or two examples. We must therefore be guided by circumstances; if the patient be healthy, and heart-whole, and if the pulse be good, the operation may be performed at once. But if he be delicate, and half senseless, if he be very faint and the pulse very languid, or it may be scarcely perceptible and intermitting, if there be yawning and sighing, restlessness with much jactitation or throwing the arms about, and occasional convulsions, and if there be vomiting, which, however, sometimes though not always acts as a re-excitant by sending blood to the brain, of which it is in great need, then we must wait till, by the cautious administration of warm water and brandy, by presenting strong liquor of ammonia to the nostrils, by fanning and bathing the face with vinegar, at the same time that warmth is applied to the feet, hands, and arm-pits, reaction is brought about and kept up for a few hours; for occasionally it happens, that though there may be a seeming revival for an hour or two, all at once the powers sink and the patient dies.

It must not be supposed that by the expression *immediate amputation* it is meant that a limb should be cut off directly after the receipt of the injury. In general practice the Surgeon rarely sees the patient till some time has elapsed, and except in hospital practice, it also requires still more time to make the necessary arrangements; at the very earliest, therefore, it usually happens that the operation cannot be performed till four or five hours after the accident, which is ample time, except in cases of extreme sinking, for the patient to recover himself, and screw up his courage to the sticking place; but earlier than this time I should not be inclined to operate, and if the shock be very great, it will often be necessary to wait for twelve or twenty hours, according to circumstances, before it will be either prudent or safe to amputate.

When, as happens in very rare cases, that the amputation of two limbs is necessary, it is a point of great difficulty to determine what course is best to pursue. Cases have occurred in which both limbs have been immediately removed, one directly after the other, or one immediately, and the other some time after, and the patients have done well; whilst, on the other hand, these practices have been adopted and the patients lost, almost immediately after the operation or operations. These cases are beset with extreme danger, and it is next to impossible to give any positive directions on the subject, beyond employing the most careful attention to the patient's constitutional powers, before proceeding with one or other mode of practice. But it may be presumed, if after the first operation the patient's powers seem declining, that the second operation would be deferred. Whilst on the contrary, if he bore the first operation well, it would be encouragement to perform the second immediately, so as to put him in the best condition possible.

3rdly. *Of the consequences, immediate and remote, of compound fracture.*—The immediate consequences of compound fracture, should the shock of the accident not be so great as at once to check all attempt at reparation, and destroy the patient in a very few hours, make their appearance sometimes within twelve hours, but more frequently about the third or fourth day, assuming the character of

Sympathetic, symptomatic, or *irritative fever;* or, as JOHN HUNTER chooses to call it, "sympathetic inflammatory fever," of which ABERNETHY has given a concise but excellent description. "A person," says this able teacher (*a*), "has a compound fracture; here is local injury acting on a sound constitution. He does not sleep, and if he doze, he soon wakes up in agitation and alarm; the pupil of the eye is contracted, that organ becoming more susceptible; his pulse is more strong, firm, or hard, more full and frequent than usual; there is diminution of the secretions, the skin is dry and hot, the urine scanty and high-coloured, the tongue dry and white, and the digestive organs disordered, and disposed to costiveness; there is much thirst; no appetite, or if the patient be inclined to food, it is for the vegetable acids. If the person be bled, the blood is slow in coagulating, the surface of the clot contracts; in short, it has an inflammatory appearance. If any vital part is affected, there is more disturbance of the system; the pulse is more hurried and not of the same strength as before; but the general symptoms are the same. No explanation of these symptoms is required; there is excitement of the nervous system, with increased action of the sanguiferous, accompanied with diminished secretions and disturbed digestive organs. But with these symptoms there will be no sinking or depression of strength, no consciousness of debility. Sometimes this fever is preceded by shivering or sickness, both probably arising from the state of the stomach; but a healthy person will often be affected with neither. There appears to be in some persons a susceptibility for this fever, so that the slightest accident will occasion it; whilst others, on the contrary, show much less susceptibility under more extensive injuries."

"These symptoms," to use JOHN HUNTER'S expression, "are the sympathies of the constitution with a local disease or injury, and will vary according to a vast variety of circumstances. They will vary according to the nature of the constitution, which admits of great differences, and which will include different ages; they will vary according to the nature of the part in a state of disease, which also admits of great differences; they will vary according to the quantity of mischief done, as well as the manner of its being done; that is, whether so as to call forth immediate inflammation, as a wound; or not so immediate, as from having only killed a part; they will vary according to the situation of similar parts in the body, and they will vary according to the stage of the disease." (p. 396.)

HUNTER further observes:—"The constitutional symptoms arising from a local complaint may be divided into three as to time; the immediate, indefinite, and remote. Of the first, or immediate, there appears to be but one; of the second there is probably a variety, at least appearing in very different forms and at very different periods, in respect of the original cause: of the remote there is probably only one. The immediate I shall reckon that which is called the symptomatic fever; and what I shall reckon the second are nervous affections, as spasms, both temporary and permanent, and delirium. Whether the symptomatic fever, the spasms, or the delirium come first, is not certain, for often all concur or occur at the same time; but as the sympathetic fever is the most constant, and is more an universal principle, it is to be reckoned the first. And the third, which I have called remote, is what is understood by the hectic; to which may be added the symptoms of dissolution, which is the last stage of all, and may be the consequence of the above or any other disease." (p. 406.)

In symptomatic fever, which is now under consideration, "the symptoms," still using HUNTER'S words, "continue more or less according to the degree of the injury, the nature and situation of parts, and the constitution; but as they arise from a local cause, which subsides, they of course subside also. * * * The subsiding of these symptoms is the cure; and where they are simply the effects of violence the fever cures itself, therefore the only thing necessary is to lessen its violence." (p. 409.)

The sympathetic fever in compound fracture almost invariably begins to subside as suppuration commences in the wound, and gradually disappears as healthy suppuration is established; hence it has been generally considered as "necessary for the operation of suppuration," an opinion which JOHN HUNTER very stoutly, though not very satisfactorily, combats, for it cannot be denied that, with scarcely an exception, when suppura-

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(*a*) MS. Lectures. I have preferred this account to HUNTER'S on account of its brevity. But the reader will do well to study carefully that writer's observations on the effects of the suppurative inflammation on the constitution, (p. 326,) in his work on inflammation.—J. F. S.

tion is set up the febrile excitement diminishes, and hence it may be fairly inferred that it plays an important part in setting up that process; and simultaneously with the latter, generally, commences granulation, by which the reparation of the injury, as well of the bone as of the soft parts, is effected. And thus, under the most favourable circumstances, are most compound fractures cured.

But oftentimes these injuries do not thus terminate; there is no subsidence of the sympathetic fever, no appearance of suppuration, the constitutional excitement increases, and the "secondary constitutional, or nervous symptoms," as JOHN HUNTER calls them, come on, oftentimes under peculiarly irritable states of constitution, within a very few hours after the accident, and "concur, or occur at the same time," as he justly observes, almost with the onset of the sympathetic fever, so as it would seem really to be one of its conditions. And of these nervous symptoms the delirium is one of the most striking, and "appears to arise from nervous affection of the brain or sensorium producing a sympathy of the action of the brain with the *materia vitæ* of the parts; *not sensation, as a head-ache, but action, producing ideas without the exciting impression*, and therefore delusive." (p. 410.) Under these circumstances there is for a time also great vascular excitement, which may endure for four, five, or a few days longer, and is then followed by a change, frequently very rapid, to symptoms of a typhoid character, the powers of the constitution having been exhausted by the previous excitement, and the patient more or less quickly sinks and dies. Sometimes the nervous symptoms assume the tetanic form, which more especially happens when there has been much laceration; and I think I have not less frequently noticed that the tetanus makes its appearance without any very violent sympathetic fever, and occasionally when the case has appeared to be promising favourably.

When sympathetic fever have once set in, either without or with these nervous affections, there is no choice left but to wait till its subsidence; no amputation can then be performed without every probability of hastening the patient's dissolution. The irritating cause must, therefore, still remain, and the contest between it and the constitution is kept up till one or other be vanquished. Too often, however, in these cases is it seen that though the constitution have power to struggle through the sympathetic fever, yet has it only sufficient strength to carry on to the remote or hectic period, when with much diminished powers the same course is again to run, with the additional drain of profuse suppuration,

Hectic fever, "when a consequence of a local disease, has commonly been preceded," says JOHN HUNTER, "by the first process of the former, viz., by inflammation and suppuration, but has not been able to accomplish granulation and cicatrization, so as to complete the cure. It may be said to be a constitution now become affected with a local disease or irritation, which the constitution is conscious of, and of which it cannot relieve itself, and cannot cure; for while the inflammation lasts, which is only preparatory, and an immediate effect of most injuries, and in parts which can only affect the constitution, so as to call up its powers, there can be no hectic. (p. 496.) Hectic may be said to be a slow mode of dissolution; the general symptoms are those of a low or slow fever, attended with weakness, but more with the action of weakness than real weakness; for, upon the removal of the hectic cause, the action of strength is immediately produced, as well as every natural function, however much it was decreased before. The particular symptoms are debility; a small, quick and sharp pulse; the blood forsaking the skin; loss of appetite; often rejection of all aliment by the stomach; wasting; a great readiness to be thrown into sweats; sweating spontaneously when in bed; frequently a constitutional purging; the water clear." (p. 499.)

Such is the condition into which the patient with compound fracture frequently falls, sometimes sooner, sometimes later after the establishment of suppuration, and of which it may be mostly truly said with HUNTER:—"We have as yet, I am afraid, no cure for any of the consequences above related; I believe that depends on the cure of the cause, viz., the local complaint, or in its removal; the effects I fear are not to be cured." (p. 503.) But even under these discouraging circumstances, hope is not to be lost; and whoever has had much experience will agree with this great Surgeon in the course to be pursued, and the results which often follow. "When the hectic," says he, "arises from local diseases, in such parts as the constitution can bear a removal of, then the diseased part should be removed, viz., when it arises from some incurable disease in an extremity, and although all the symptoms above described should have already taken place we shall find, that upon a removal of the limb the symptoms will abate almost immediately. I have known a hectic pulse at 120 sink to 90 in a few hours upon the removal of the hectic cause. I have known persons sleep sound the first night without an opiate who have not slept tolerably for weeks before. I have known cold sweats stop immediately as well as those called colliquative. I have known a purging immediately stop upon the removal of the hectic cause, and the urine drop its sediment. It is possible too that the pain in the operation and the sympathetic affection of the constitution may assist in these salutary effects. It is an action diametrically opposite to the hectic, and may be said to bring back the constitution to a natural state." (p. 504.)

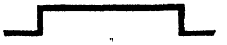
4thly. *Of the advantage hoped for by the immediate removal of the injured parts in preference to the attempt at saving them.*—From the amputation of a limb which has suffered compound fracture, we hope by removing an irritating cause, and by bringing about the adhesive instead of the ulcerative process, or in other words by making a clean cut wound, in place of a torn and bruised wound, and so causing union by adhesion, instead of by suppuration, to prevent or at any rate to lessen the irritative fever, which is always expected, and which indeed is only indicative of the constitutional excitement necessary for the repair of such injuries. Such was JOHN HUNTER's opinion, for he observes:—" Simple violence, even with the loss of a part, is not of such consequence as we should at first imagine; for, in consequence of the loss of a limb, if the parts are allowed to heal by the first intention, the constitution is but little affected; it is, therefore, violence with loss of substance, and which is to produce inflammation and suppuration, that gives rise to the constitutional symptoms, and when these commence, or more probably when the part sets about these operations, the constitution becomes affected. It is more the new disposition in the parts than the quantity of inflammatory action in them by which the constitution is affected; for we shall see that upon the simple commencement of the suppurative disposition, before it takes place, rigors, &c., come on." (p. 400–1.)

The object of immediate amputation is then to prevent, as far as possible, the constitution acquiring this suppurative disposition, and the accompanying irritative fever, and to encourage the quieting of the constitutional excitement necessary for the reparation of the injury, by converting a wound, which would, in course of its cure, greatly disturb the vital forces, into one which might be expected to proceed to union with comparatively little effort on the part of the constitution. It must be admitted, that sometimes after early amputation, the adhesive process will not take place, but the whole surface of the stump becomes sloughy, and the sympathetic fever runs high, and even destroys the patient. I do not, however, think the possibility of such occurrence an objection to the early operation, as it is probable, that the same kind of constitution producing these effects, would have equally produced them, had no operation been performed. So that in reality, the patient's condition is not, under any circumstances, rendered worse, and if he scramble through, is better, inasmuch as the operation having been performed, no repetition of violent shock to the constitution is called for in way of amputation. I have myself so frequently and successfully pursued the practice of immediate amputation, and have seen it practised in our hospital by my colleagues with advantage, that I have no doubt of its propriety. One important point, however, in the constitutional treatment must not be overlooked, as upon that I consider our success has mainly depended, viz., as far as possible to preserve the patients' ordinary mode of living, especially if they have been accustomed to large quantities of beer or spirits; for if these be withdrawn, or even not given in such quantity, as by some would be considered, highly improper, the patient will most assuredly sink. On this point, therefore, we must cautiously feel our way, and give either beer or spirits, or both, as the patient may seem to require, and may be able to bear. It is also right to observe that the constitutional excitement, whether amputation be or be not performed, is most to be feared in injury of the lower limbs. Whilst on the contrary, early amputations of the upper limbs almost invariably recover without the least drawback.—J. F. S.]

591. In the *treatment* of fractures, especially of those which are compound, and of the lower limbs, the use of a *suspensory apparatus* has been recommended, in which the broken limb lies entirely free, and the application of proper remedies to the wounded part, and the motions of the limb are possible. Greatly convenient, however, as this apparatus is to the patient, it can only be used in transverse fractures in which the contraction of the muscles is not so very much opposed to it. The *swing*, however, connected with continued extension affords great advantages.

[There are two modes of treating compound fracture, which, from repeatedly pursuing, I am convinced are, generally, the best of all that have been proposed. The first is the bracket-splint used by ABERNETHY, which can be applied on any limb; and the second is the swing-box, or slings, which can only be used for the fore-arm and leg;

with which also Abernethy's splint may be combined if requisite. I know no apparatus capable of more perfectly steadying the limb than these, at the same time that they afford the greatest convenience for dressing the wound, as frequently as the Surgeon pleases, without disturbing the position of the fractured bones.

Abernethy's *bracket-splint* is made of either one or other of the pair of common wooden splints, both of which, if for fractured leg, should always have foot-pieces. The splints having been properly selected to the size of the limb, that one which is to be applied on the wounded side is to have screwed on its outer surface, and vertical to it, opposite the wound, a pair of stout iron wire brackets of this shape  of sufficient length, from four to six inches, to reach at either end far beyond the wound of the soft parts, and about three inches high, so that the hand and a poultice, or any other required dressing, may be passed beneath without touching them. The brackets being firmly screwed, that part of the splint between their vertical legs is to be sawn out; and thus, without the strength of the splint being diminished, and leaving plenty of each end, over which a roller can be passed around the limb and the other splint which is still whole, the entire limb is firmly fixed, and the movements of the fractured ends of the bone entirely prevented; whilst at the gap, in the bracket-splint, the wound remains free from pressure and completely exposed, so that it can either be dressed or poulticed with the greatest ease. These splints may remain undisturbed for weeks, till the wound is healed, and common splints, or gum or starched roller can be applied at the Surgeon's choice. These bracket-splints have also the advantage that if the patient be wearied by the position, it can be changed to another, and again restored to the first position without the least danger or difficulty. Very few indeed are the cases of compound fracture in which this apparatus does not answer extremely well. It can easily be made, and whoever can properly apply a pair of common splints can as readily apply these.

The *swing-box* consists of a flat board about two feet and a half in length and about a foot wide, near the four corners of which are fastened as many vertical wooden pillars, about an inch square, or of sufficient thickness to allow a small pulley sheave to be mortised into the upper end of each, over which a stout cord plays, with its outer end free, and the inner end attached to the corners of a gutter-shaped box, of rather smaller size than the bottom of the apparatus, so that it may freely move backwards and forwards, and upwards and downwards within the pillars. This wooden gutter is open at the hinder end and above; but the front end has a vertical foot-piece moving backwards and forwards in a chase, so that it can be adjusted to the sole of the foot, whatever be the length of the leg; the bend of the knee being always placed just beyond the hind end, and quite free from the gutter. For the arm, of course, no vertical end is requisite, as it lies flat, and the elbow-joint also is to be quite independent of and behind the bottom of the gutter. The sides of the box, being attached with hinges, can be dropped one or other, or both, as may be requisite for the convenience of the dressing. A thick pad is placed in the bottom, and the limb, being laid on it, is to be kept in place by other pads which fill up the space between it and the sides of the box, so as to give support to the limb. If the wound be at the upper surface, it can be dressed without any movement of the sides of the box, which serve for splints; but if the wound be on either side, the corresponding side of the box must be dropped each time, and replaced and fastened after the dressing. Sometimes the swing-box is used without sides, one or two bracket-splints, according to circumstances, being also used; and this is best when the part requires frequent change of dressing, and of necessity must be handled by the nurse, on which account every precaution should be taken to prevent the fracture being disturbed. Before the limb is put into the box, it is to be drawn up by the cords to such height as may be thought convenient, and either end or side depressed according to circumstances; after which the ends of the cord are fastened securely to studs on the outsides of the pillars. During the course of the treatment the elevation or depression of the box may be effected by the cords, without at all interfering with the setting of the fracture itself. The great advantage of the swing-box is that in the patient's movements of the injured limb, however small, the whole limb must move together, so that the ends of the bone do not jostle each other, as in the common mode of treatment. It is by far the best apparatus to be used if the patient be restless and unsteady, and will generally carry a case well through, when no other method will.

There is another kind of swing apparatus which I have once or twice employed, though by whom invented I do not know. It consists of a board and pillars as in the former case, but instead of having sheaves and cords, a stout rail connects each two side pillars, and to these the ends of a Scultetus's bandage are attached by pins on each side; a ship's cot is thus formed, in which the limb lies, immediately and closely supported without any splints, and swings without any disturbance of the fractured ends of the bone. If the wound be on the side, or on the back of the leg, it is easily dressed by unpinning an end of one or more pieces of the bandage, the other pieces still keeping up the suspension.

Either of the swing-apparatus may be used for simple fracture, and the swing-box often is advantageous when the fracture is very oblique, and the patient very unsteady.

Some Surgeons prefer treating compound fractures with **Amesbury's** apparatus; but I prefer either of those I have mentioned. Sometimes, however, the one will answer when the other will not, and the employment of either must be left to the Surgeon's judgment.—J. F. S.]

592. After the cure of the fracture a stiffness generally remains in the neighbouring joints, which gradually subsides under the use of volatile rubbing, baths, and by the motions of the joint. To prevent the stiffness an early motion of the joint has been recommended; but when the joint is inflamed such early movements only increase the danger of stiffness.

593. The re-breaking of badly-united fractures, recommended from the earliest times, has been of late years universally rejected as rough and unnecessary. **Oesterlen** (*a*) has, however, communicated some very good observations on this subject, from which it appears that, in fractured bones so badly cured that considerable deformity, great curving and shortening of the limb are produced, its use completely destroyed or rendered exceedingly difficult, continued pain and the like caused, if no more benefit can be gained by extension and bandaging, and if the person be not too old, too weak, suffering from consumption, gout, and the like, the re-breaking of the bone in the callus may be attended with the most happy results. How long this breaking of the callus may be possible is not determined; it, however, depends on the state of the patient, on the condition of the broken bone, the place of the fracture, the size and condition of the callus. **Oesterlen's** observations prove that the operation on the bones of the thigh and leg healed with a large quantity of callus, may be performed even in the seventeenth week with happy result; his experiments made on the human subject principally go only to the twenty-sixth week. In young persons and in bones not strong, as those of the-fore arm, re-breaking of the callus is possible even after the lapse of a year, if the callus be not particularly thick.

594. If the callus be still recent and not in great quantity, the fracture can be effected by pretty strong extension and counter-extension, and by pressure upon the callus with the hands. If, however, the callus be tough the re-breaking is best managed by a proper apparatus. **Bosch** has proposed for this purpose a screw-machine, like a printer's-press, between the boards of which the limb is laid, and the pressure effected by a screw furnished with a pad. **Oesterlen** (*a*) has altered this machine, so that the part furnished with the screw is fixed at both ends on the limb (*Dysmorphosteopalinclastes.*) **Wasserfuhr** (*b*) divided the soft parts over a thigh-bone united at a right angle, sawed into the callus, and then broke it by pressing a wooden pyramid covered with leather in a proper direction upon the callus. When the break has been effected, it must be treated according to the general rules.

Here must be mentioned the pretended softening of callus by plaster, poultices, salves, and the like; the treatment according to the kind of distortion by stretching and pressing

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(*a*) Ueber das künstliche Wiederabbrechen fehlerhaft geheilter Knochen der Extremitäten *im Callus*, zum Behuf einer besseren, geraden Heilung. Tubingen, 1827. 8vo. with a lithographic plate.

von Graëfe in his Journal für Chirurgie, vol. xxi. pt. i.

Blasius in Med. Vereinszeitung in Preussen, 1833. No. xlix.

Jerichow, Dissert. de Osteopalinclast. Hal., 1833.

(*b*) In **Rust's** Magazin, vol. xxviii. p. 306.

[illegible] scraping and rasping thinner, by a seton drawn through the callus (*a*), by division with the saw, chissel, and hammer (*b*). By the internal use of the Carlsbad waters, **Briesche** (*c*) has observed, in a few days, such a dissolution of a recent but properly formed callus that motion was again noticed at the fracture.

[594.* Before closing the subject of fractures in general it will be well to notice the *bending of bones* produced by falls or other violence, when, from a deficiency of earthy matter in their walls, they will not break. I have seen it several times in weakly children, more commonly in the upper than in the lower extremity. The bone or bones are usually more or less bent in the middle, just as a softened stick of sealing wax might be bent. Of course no crepitation is to be expected, nor is the injury accompanied with much pain even on handling. No forcible attempt should be made to restore the natural position of the bone, for if such be made the probability is that it will break in two. Gentle bending back will sometimes diminish the deformity; but it is best to apply a well-padded splint lengthways on the concavity, and gradually, by repeated rolling from day to day, to bring down the bend; and when this is affected, the limb may be enclosed in a pair of splints, and so kept for three or four weeks, during which time the constitution should be strengthened by tonic remedies.—J. F. S.]

Second Chapter.—OF FRACTURES OF BONES IN PARTICULAR.

I.—OF FRACTURE OF THE NOSE-BONES.

(*Fractura Ossis Nasi*, Lat.; *Bruche der Nasenknochen*, Germ.; *Fracture de l'Os du Nez*, Fr.)

595. *Fractures of the Nose-bones* are, on account of the projection of the nose and the few soft parts which cover it very frequent, always consequent on immediate violence, and therefore always accompanied with bruising or wound. The fracture may be simple, vertical, or transverse, in which cases the separation of the broken ends is slight, and the *diagnosis* difficult or impossible, if there be much swelling; or the nose-bones may be broken into many pieces which are pressed in, so that the *diagnosis* is easy from the great deformity. Fractures of these bones may be accompanied with severe bleeding, and with symptoms of pressure or concussion of the brain, which latter symptoms depend on the propagation of the violence to the brain, and not on the pressing in of the walls of the nose, or of the cribriform plate. If the displaced bones cannot be returned to their proper place, great deformity always remains. In compound fractures of the nose-bones suppuration and exfoliation of bone easily follows. Such injuries may be fatal from accidental affections of the brain.

596. In *simple* fracture of the nose-bones without displacment the *treatment* consists simply in the general and local use of antiphlogistic remedies, in order to prevent or disperse the inflammation and swelling of the parts. If the edges of the fracture *be pressed in*, they must be raised by the introduction of a female catheter, or the handle of a scalpel covered with linen, into the nostril, the forefinger of the left hand being placed on the outer surface of the depressed pieces of bone, to prevent them being

(*a*) **Reinhold** in **Hufeland's** Journal, 1826, s. 5.

(*b*) **Riecke** in **Oesterlen**, p. 138.—**Clemot** in Zeitschrift für die gesammte Medecin, vol. iii. p. 118.

(*c*) **Hufeland's** Journal, October, 1816.

thrust too much out. The raised pieces having little disposition to fall in again, it is therefore in most cases superfluous and injurious to keep them in place by stopping up the nostrils with plugs, or by the introduction of elastic tubes (which foreign bodies always increase the inflammation.) Only in cases in which the broken ends are again displaced must they be used. Dispersing applications are to be employed for diminishing the inflammation; but the ridge of the nose must not be pressed by them.

For these reasons it is plain that all bandages are useless and hurtful; nor is the case of pasteboard, or *papier maché*, used by Dzondi (*a*), of much consequence.

597. If severe inflammation and swelling have already occurred, we must first endeavour to lessen these by proper treatment before *setting* the fracture. This, however, must not be long delayed, as it otherwise becomes impossible, and an irremediable deformity remains. The bleeding in fractured nose may be so great as to render necessary the applications of plugs by means of Belloq's tubes. In case symptoms of brain-affection should be present, the treatment must be directed to them.

II.—OF FRACTURES OF THE CHEEK-BONE.

(*Fractura Ossis Malæ*, Lat.; *Bruche der Jochbeine*, Germ.; *Fracture de l' Os de la Pommette*, Fr.)

598. *Fracture of the Cheek-bone* is rare, and mostly accompanied with crushing and wound of the soft parts. The arch of the cheek (*zygoma*) may, on account of its form, be easily broken if violence be applied to it directly; it may at the same time be split or the broken edges may be driven in. As the violence to produce this accident must always be very great, it may also affect the brain. From the tearing of the soft parts severe inflammation and nervous symptoms may come on.

599. The *diagnosis* of this accident is always easy, if the swelling of the soft parts be not great. If the ends of the fracture be not displaced, nothing better can be done than to subdue the inflammation by proper *treatment:* the patient must keep the jaw (which should be fastened with a halter bandage) quiet; he must not speak and only take fluid food. If the ends of the fracture be pressed in, the finger must be introduced into the mouth for the purpose of restoring them to their proper place. In those cases only in which the fractured pieces are driven into the temporal muscle, whereby chewing and swallowing are prevented, and which cannot be raised up by the introduction of the finger into the mouth, it would perhaps be indicated to cut through the integuments down to the bone, and to raise the pieces with an elevator.

600. If the alveolar process be broken, in which case the teeth usually become loose or fall completely out, these as well as the loose pieces of bone must be again pressed into their place, where they frequently adhere; the jaw is to be fixed with the halter-bandage, and the accompanying bruising of the soft parts treated according to the rules laid down.

Graëfe, in a case of fracture of the upper jaw, in which both upper jaw-bones were so separated from all their connexions that together with the rows of teeth they could be displaced at pleasure, used a peculiar machine for keeping them steady (*b*).

(*a*) Lehrbuch, p. 578.

(*b*) Reich, Dissert. de Maxillæ Superioris Fracturâ. Berol. 1822.—Journal von Graefe und von Walther, vol. iv. p. 592. vol. v. p. 353. Pl. iii. f. 18.—Cloquet, (J.) Mémoire sur les Fractures par contre-coup de la Machoire Supérieure. Paris, 1820.

[I once saw a very remarkable accident in which a man received a violent blow on the face from the handle of a crane whilst flying round. All the bones of the face, excepting the lower jaw, were separated from the skull, partly broken from it and perhaps torn from it at the harmonies. The nose, cheek, and upper jaw-bones were broken and crushed, so that the whole face below the eyes, including the floors of the orbits, could be moved with the least effort, and yielded in every way to pressure of the fingers, just as would beans in a bag. Externally there was only a slight graze, but he bled from the nose and mouth, the lining membranes of which were torn. In the course of a few hours the face swelled considerably from the effusion of blood, and entirely lost its shape. Nothing was done beyond the application of an evaporating lotion, the swelling subsided in the course of a short time, and he recovered after having had a little exfoliation from the mouth and nose; but a shallow furrow across the face and a broken nose-bridge were the result of the injury. He lived many years after, and a cast of his head is in our Museum.—J. F. S.]

III.—OF FRACTURES OF THE LOWER JAW.

(*Fractura Ossis Maxillaris inferioris*, Lat.; *Bruche des Unterkiefers*, Germ.; *Fracture de la Machoire inférieure*, Fr.)

601. *Fracture of the Lower Jaw* is rare, partly on account of the strength of the bone, and partly on account of the great mobility of the jaw. The fracture takes place either between the middle of the bone and the insertion of the *m. masseter* (the fracture of the middle of the bone itself is extremely rare (*a*)); or between the insertion of that muscle and the coronoid process, (fracture of the angle of the jaw,) or the coronoid and condyloid processes are themselves broken off. The direction of the fracture is either horizontal, vertical, or more or less oblique. The lower jaw may be broken at the same time in several places. Most commonly there is much bruising and injury of the soft parts, tearing of the nerves and of the accompanying vessels passing through the infra-maxillary canal, which produce nervous symptoms, convulsive motions of the muscles of the face, severe pain, deafness, or violent bleeding (1). The ends of the broken bone are generally displaced; the piece on which is the chin (*symphysis*) is drawn down by the action of the depressing muscles, and the other piece upwards by those which raise the jaw; and this happens so much the more as the fracture is farther distant from the chin. If the fracture be oblique, the front broken end is always drawn back. In double fracture the middle portion is always decidedly displaced downwards. In fractures of the angle of the jaw, the broken ends are little or not at all displaced; and in that of the neck of the condyle it is drawn forwards by the *m. pterygoideus externus*, whilst the rest of the jaw retains its natural position.

[(1) It cannot be denied that the serious symptoms just mentioned may occur, but I have never seen them, not even when the fracture has been compound, which is an uncommon accident. Simple fracture of the sides of the jaw, near the bicuspid teeth, frequently occurs, as the result of a blow with the fist; but I have never seen fracture of the ascending plate that I recollect.—J. F. S.]

602. The *diagnosis* of this fracture depends on the preceding violence, on the severity of the pain, on the unevenness of the base of the jaw, and of the row of the teeth, and on the crepitation when the broken ends are moved up and down, which is the only sign of fracture without displacement. In double fracture the displacement is usually considerable. In fracture of the neck of the jaw, the forward displacement of the condyle

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(*a*) Rouyer, Journal Général de Médecine, April, 1808.

is noticed, as also a space behind the angle of the jaw, immobility of the condyle and crepitation in the motions of the jaw which are accompanied with pain.

603. The *setting* of this fracture is easy, but in double or oblique fractures it is very difficult to keep the broken ends in their proper place; deformity and displacement of the natural position of the teeth commonly remains.

The setting is performed by pressing back the coronoid process with the fore finger of one hand and with the other, placed on the inside of the jaw, the horizontal branch is drawn forwards and in oblique fracture somewhat upwards. The proper range of the teeth and the evenness of the lower edge of the jaw certify the setting. When the displacement of the ends of the fracture is but slight, it is sufficient to press the under jaw against the upper in order to effect the setting.

604. To keep the ends of the fracture in their places the middle of a long pad should be placed beneath the chin and the ends brought over the crown of the head, where they are to be fastened together; a similar long pad is carried over the front of the chin to the back of the head, and there also fastened. Over these compresses a simple halter-bandage is applied. A simple head-cloth is also advisable, by which the motions of the lowre jaw in wide opening of the mouth, are prevented. In oblique fractures, a piece of cork provided with a furrow, may also be placed between the teeth of the not displaced part of the lower and the upper jaw, and the depressed fractured end should be properly raised with a bandage; this is, however, unnecessary, and may easily endanger a deformed union. In double fracture the double halter, or Schreger's bandage, may be applied to the jaw. A graduated compress is to be placed on the under side of the jaw, and over it a hollow pasteboard splint will increase the solidity of the apparatus.

605. In fracture of the neck of the jaw-bone the broken ends are to be brought together, the under part to be pressed forwards, or so that a piece of cork may be placed between the hinder grinding teeth; or a graduated compress may be laid behind the angle of the jaw, and the turns of the halter-bandage made thereon.

606. The apparatus must be re-applied at the tenth or twelfth day, unless previously loosened; then at the twenty-fifth, (when union has generally taken place,) and at the fortieth when it is perfectly firm. During the cure the patient must avoid all talking and chewing, he must be fed on thin food, and be careful not to lie at night on the injured side. Some time also after the cure chewing hard food must be avoided.

Compound fractures of the lower jaw must be treated after the general rules.

607. Special contrivances for the cure of fracture of the lower jaw, whereby it is pressed up against the upper jaw, and the mouth not kept closed, have been recommended by Ruetenich, Kluge, (*a*) Bush (*b*), and Hartig (*c*), but they are less suitable than the apparatus just described, as they rarely fit completely, irritate the mouth, and render the patient very uncomfortable.

Wallner (*d*) applies, (as did previously Hippocrates, Ryff, and others,) in fracture

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(*a*) Branco, Dissert. de Fracturâ Mandibulæ. Berol. 1823.

(*b*) London Medical and Physical Journal, Nov. 1822.

(*c*) Journal von Graefe und von Walther vol. v. p. 346. Pl. iii.

(*d*) Magazin der Ausländ, Literatur von Julius und Gerson, May and June, 1826, p. 519.

of the lower jaw, instead of the usual apparatus, a silver thread around the front teeth, which, without inconveniencing the patient, may be continued for three weeks till the divided parts are perfectly united.

IV.—OF FRACTURE OF THE TONGUE-BONE.

(*Fractura Ossis hyoïdei*, Lat.; *Bruch des Zungenbeines*, Germ.; *Fracture de l'Os hyoïd*, Fr.)

MARCINOVSKY and DIEFENBACH; in Medic. Vereinszeitung für Preussen, 1833. Nos. 3 and 15.

LALESQUE; in Journal Hebdom., vol x. p. 386, 1833.

AUBERGE; in Revue Médicale, July, 1835.

608. *Fracture of the Tongue-bone* is very rare, but always consequent on direct external violence, and almost always occurs in the horns of the bone. In consequence of the injury itself and the displacement of the broken ends there is always impossibility of swallowing and speaking, or great difficulty and pain in so doing, and in depressing and protruding the tongue, symptoms of suffocation, effusion of blood, and swelling of the region of the tongue, grating and mobility of one or both horns when touched, inflammation of the throat and *pharynx*. The broken bone may be displaced towards the throat and project so that it can be felt with the finger (LALESQUE, AUBERGE.)

[The only examples of fracture of this bone of which I am aware are those of persons executed by hanging, in which fracture is almost invariably found.—J. F. S.]

609. If there be not any displacement of the end of the fracture towards the throat, it must be pressed into its proper place by introducing the finger, whilst the other hand fixes the tongue-bone externally; a strict antiphlogistic treatment, blood-letting, leeches, cold applications, nitre in some mucilaginous vehicle, and extract of hyoscyamus or laurel water, must be employed to prevent or get rid of the inflammatory symptoms. The patient must swallow only fluids, and in small quantity. If swallowing be impossible, or the ends of the fracture be thereby again displaced, an *œsophagus*-tube must be introduced, or the patient nourished with clysters.

V.—OF FRACTURE OF THE CARTILAGES OF THE LARYNX.

(*Fractura Laryngis*, Lat.; *Bruch der Knorpel des Kehlkopfes*, Germ.; *Fracture du Cartilage du Larynx*, Fr.)

610. The cartilages of the *larynx* may be broken variously by the immediate operation of severe violence; and speedy death may result from the displacement of the ends of the fracture by suffocation, or very violent symptoms may ensue, as very difficult, snoring, noisy breathing, with the neck and head bent back, cough, with bloody foam from the mouth, hoarse inarticulate tone of voice, severe pain in the *larynx*, impossibility of swallowing, symptoms of choking, yellowish-white, livid, puffy face, protruding eyes, strong pulsation of the carotid arteries, effusion of blood, and *emphysema* in the neck, and tetanic symptoms. The mobility and displacement of the ends of the broken bone may be felt on external examination.

611. If it be not possible by careful attempts to replace the ends of the fracture in their proper position, the coverings of the *larynx* should be cut through at the mesial line of the neck in the whole length of the *larynx*, and after stanching the bleeding, or if the danger be pressing, at the same

time dividing the *larynx* throughout its whole length, and the cartilages are then to be brought into their proper place. The difficulty of breathing being thereby diminished, the edges of the wound are to be brought together with sticking plaster, but if it continue the wound should be left open. In either case inflammation must be prevented or diminished by the strictest antiphlogistic treatment.

VI.—OF FRACTURE OF THE VERTEBRÆ.

(*Fractura Vertebrarum*, Lat.; *Bruch der Wirbelbeine*, Germ.; *Fracture de la Colonne Vertébrale*, Fr.)

Cuenotte, F. A. E., Diss. Med.-Chir. sistens casum Subluxationis Vertebræ Dorsi cum fracturâ complicatæ, post factam repositionem et varia dira symptomata duodecima demum septimana funestæ. Argent., 1761.

Sœmmering, S. T., Bemerkungen über Verrenkung und Bruch des Rückgraths. Berlin, 1793. 8vo.

Cooper, Sir Astley P., Treatise on Dislocations and on Fractures of the Joints, 1822. Also his Lectures on Surgery by Tyrrell.

Bell, Sir Charles, On Injuries of the Spine and Thigh-bone. London, 1824. 4to.

Wenzel, C., Von den Krankheiten am Rückgrathe. Bamberg, 1824. fol., with eight copper-plates, p. 335.

Lisfranc, Histoire genérale des Fractures de la Colonne Vertébrale; in his Clinique Chirurgicale, in Révue Médicale, vol. iv. p. 238. 1825.

Lawrence, Will., On Dislocations of the Vertebræ; in Med.-Chir. Trans., vol. xiii. 1825.

Brodie, Sir Benj. C., Pathological and Surgical Observations relating to Injuries of the Spinal Cord; in Med.-Chir. Trans., vol. xx. 1837.

Phillips, Benj., Account of a Case of Fracture and Displacement of the Atlas; in Med.-Chir. Trans., vol. xx. 1837.

Lauth, in Mémoires de l'Académie de Médecine, vol. iv.

612. The fracture may occur in the *spinous, transverse, or oblique processes*, or in the *vertebra itself*.

The spinous processes are most subject to fracture, and this may happen without any accompanying injury of the spinal marrow. It is distinguished by the altered direction of the spinous process, by its mobility, and crepitation; it, cannot, however, be decided whether the fracture do not also extend into the body of the bone.

[Fracture of the processes alone, so far as I have had opportunity of observing, are certainly of much less frequency than fracture of the body of the *vertebra*, which may sometimes, though not always, accompany. I do not think I have seen fracture of the spinous processes alone more than twice. The mobility of the spinous process, but not alteration of its direction, which may be or not when it is broken off the arch, is its principal indication, and distinguishes it from fracture through the body, in which the spinous process always sinks and is immovable. It may be accompanied with concussion, or compression of the spinal cord by blood within the vertebral canal, and thereby simulating, the usual symptoms resulting from bony compression of the cord in fracture through the body, with its displacement, is very liable to be mistaken for it; but the regularity of the ridge of the spinous processes, generally existing, points out the difference.—J. F. S.]

613. Fracture of the body of a *vertebra* is rare (1), on account of its deep seat, its shortness and thickness, and the mobility of the whole spinal column. It can only be produced by very great violence, and is then

always connected with injury of the spinal marrow or its nerves, either by concussion, by inpressing of the pieces of bone, or by extravasation; or inflammation may ensue. Palsy of all the parts below the injury may occur either immediately, or some time after the accident; palsy of the lower limbs, of the bladder, (with alkaline state of the urine,) and of the *rectum*, if the fracture take place at the lower part of the spinal column; simultaneous tension of the belly and difficult breathing, if the fracture be higher. In consequence of lying continually on the back, which the patient is compelled to persist in, on account of the palsy of his lower limbs, inflammation and mortification occur upon the rump-bone; the palsy spreads generally further, and the patient dies of exhaustion in a shorter or longer time, four or five weeks after the accident: often, however, if he live longer, the palsy diminishes, the effects of lying heal, but at last, even years after, the patient yields to spinal consumption. If the fracture occur with dislocation above the third *vertebra*, death speedily ensues. Fractures beneath the origin of the phrenic nerves, cause palsy of the arms and of the deeper parts; it is, however, rarely complete, one arm is frequently affected more than the other if the fracture be oblique; the breathing is very difficult: death usually occurs in from three to seven days (*a*). When inflammation sets in delirium, restlessness, and priapism come on; the patient raises himself up, and tries to stand upright, and death usually happens about the fifth day (*b*). If the inflammation be lingering, its subsequent transition into exudation and suppuration of the spinal marrow, is fatal.

Phillips (*c*) witnessed a remarkable case of fracture of the first *vertebra* and of the pivot process of the second, in which the transverse ligament remained whole, and immediate death did not take place, and the patient only died forty-seven weeks after the accident, of water in the chest. Jæger (*d*) rightly supposes that the preparations of fracture of the spine healed by callus, of which I myself possess two examples, prove no more than that these fractures may unite in from eight to twelve weeks by callus or tough ligamentous bands, but not that the patient will be cured of his palsy. I also agree with him that many cases of pretended union of fractured *vertebræ* are very suspicious, and may have been only mere bruising, stretching of the ligaments, concussion of the spinal marrow. I have, however, notes of one case in which union of a vertebral fracture, accompanied with perfect palsy of the lower limbs and bladder, ensued, and the patient continued improving for ten years.

[(1) If by this expression Chelius mean strictly, fracture of the body of a *vertebra* without that of any other part of it, he is quite correct; but if he mean that fracture of the body with that of some other part of the *vertebra*, he is wrong; for I have notes of five cases which were admitted, in one year, into St. Thomas's Hospital.

Fracture of the body does not always require very great violence for its production, unless the blow be received on the fractured part. The following are two very remarkable instances in which the fracture was caused merely by jumping head foremost into the water.

Case 1. A sailor about forty years of age, in good health, jumped headlong from a ship into the sea to bathe, a sail being spread a few feet below the surface to receive the bathers, and protect them from the sharks. It is supposed, that his head was violently thrown back on coming in contact with the water or sail, as he immediately became motionless. When got on deck, all the muscles of the limbs and trunk below the shoulders were observed to be paralysed, and respiration was performed by the diaphragm alone. The circulation and temperature were natural, and the senses perfect. In a few hours after the occurrence of the accident, vomiting commenced and became more frequent till he died at the expiration of forty-eight hours.

Upon examination, the fourth cervical *vertebra* was found completely severed through its body, which was widely separated from that of the third. The left side of the

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(*a*) Cooper, A., On Dislocations.

(*b*) Bell, Charles, above cited.

(*c*) Medico-Chirurgical Transactions; and in the London Medical Gazette, March, 1836.

(*d*) Above cited, vol. iii. p. 229.

arch of the fourth was broken in three places, and forced forwards on the spinal marrow, which was crushed and lacerated. The left side of the arch of the fifth was likewise broken, and the spinous process of the third pressed down upon the fourth *vertebra*. This preparation is in St. Thomas's Museum.

Case 2. A man threw himself into a river to bathe, from a height of seven or eight feet, the water being only three feet deep. He came up to the surface and immediately fell back to the bottom. The bystanders observing he made no attempt to swim, drew him out and lifted him insensible upon the bank. Upon the arrival of the medical man he was found pulseless, but with priapism. By the use of ammonia he was revived, but his limbs were paralysed, and when admitted into the hospital an hour after, his body was cold, pulse scarcely perceptible, and the skin quite insensible, but he was perfectly sensible, complained of pain at the back of his neck, and could not move his head, which swayed about with its own weight, and was free from ache. He had great disposition to make water, but could not, and the introduction of the catheter was useless, as the bladder contained none. He said, in reference to the accident, that at the moment when he struck the water he felt his hands touch the bottom of the river, and to save his head, drew it violently back, upon which he lost all consciousness. By rubbing and putting him in a warm bed, he raised himself and was a little able to move his limbs. But about three hours and a-half after his admission, fever with profuse sweating came on and his pulse was stronger and quicker. He soon became delirious, uttered loud screams, and in ten hours and a-half from the accident died.

On *examination*, the back of the neck was largely ecchymosed, the interspaces of the muscles were gorged with blood, and the vertebral canal filled with it. The body of the fifth neck *vertebra* was broken across above the middle of its depth, and the two pieces were completely separated from the lateral parts.

Reveillon (*a*), who relates the case, thinks that as no contusion was apparent on the head, and that, as it was not even smeared with dirt, it could not have touched the bottom of the river, and therefore that the fracture must have been caused by muscular action.

The fracture is, however, more commonly caused either by falling down head foremost, or by a heavy weight dropping from a height upon the top of the head. In either case, the muscles being unprepared for receiving the violence, the necessary bracing up of the spine is therefore deficient, and consequently the spinal column is either bent suddenly, violently, and excessively forward, and the force being transferred to one *vertebra*, the hinder edge of the bone is more or less torn from the intervertebral substance, or the latter is at this part partially torn through, whilst the remainder still continues connecting the body of the *vertebra* with that of the *vertebra* immediately below, of which the fore and upper part is broken off obliquely downwards and forwards, and in this way the *vertebra* above the fracture, and with it the fractured upper part of the *vertebra* below, glide forward till the arch of the upper rests against the back of the body of the lower *vertebra*, and thus compresses the spinal cord. This compression is more complete if the capsules of the articular processes have been torn through, the processes themselves broken off, or the arch fractured, under which circumstances that part of the spine above the fracture slips further forward, and the spinal arch is more tightly pressed upon the spinal cord. The injury which the spinal cord suffers may be either—1, simple concussion; 2, simple compression by bone; 3, extravasation of blood either without or within the sheath, or in both situations, and producing symptoms of compression; 4, extravasation of blood on the exterior of the cord itself; 5, tearing of the cord to a greater or less extent, sometimes completely through; and either of these may or may not be accompanied with corresponding tearing of the sheath. There are not any peculiar symptoms which point out the extent of the mischief so as to assist in forming a *diagnosis*. The subsidence of the symptoms in a few days after the accident, in cases usually considered as concussion of the cord, is therefore no proof of such being really the case, as it may be possible that in slight extravasation of blood, which at first would produce symptoms, the spinal cord would probably accommodate itself to the pressure, and the symptoms subside under proper treatment, as is well known they do, and the patient completely recover, after apoplectic effusions in the brain.

The dangerous circumstances connected with fracture of the spine do not depend on the fracture itself, but upon the injury which the cord sustains, and which is greater or less, according to the greater or less displacement forwards of the upper part of the spine beyond the lower. This displacement almost invariably accompanies the fracture, and varies according to the violent bending or blow which the spinal column suffers. I have known the upper *vertebra*, with the broken upper edge of that beneath it, projected scarcely a quarter of an inch; and I have known it thrown forward more

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(*a*) Journal Général de Médecine, &c., xcviii. or xcvii of the Second Series. March, 1827.

than half an inch; and in these cases the spinous process of the projecting *vertebra* presses less or more the spinal marrow between itself and the back of the body of the lower *vertebra.* The least displacement of the vertebral body occurs in the neck; and indeed in the upper part of the neck scarcely happens.

Fracture of the spine may, however, exist without displacement, and without symptoms, even if the *atlas* be the fractured bone, as in the elder **Cline's Case.**—"A girl received a severe blow upon her neck; after which it was observed, that whenever she wanted to look at any object, either above or below her, she always supported her head with her hands, and then gradually and carefully elevated or depressed it, according as she wished, towards the object. After any sudden shock, she used to run to a table, and placing her hands under her chin, rested them against the table until the agitation occasioned by the concussion had subsided. Twelve months after the accident the child died, and on *examination* a transverse fracture of the *atlas* was found, but no displacement. When the head was depressed or elevated, the dentiform process of the second *vertebra* became displaced, carrying with it a portion of the *atlas,* occasioning pressure on the spinal marrow, which was also produced by any violent agitation" (*a*).

Phillips's case of fracture of the *atlas,* and of the pivot of the *axis,* has been already mentioned by **Chelius**; but he has omitted to state the very remarkable position and condition of the parts as found on examination. "The condyles of the *occiput* still rested upon the articulating surfaces of the *atlas,* but the *atlas* was found to be, not a separate and independent *vertebra,* but an appendix to the *axis.* So much of its anterior portion as includes the surfaces by which it is articulated with the *occiput* and with the *axis,* had been violently separated from the posterior portion of its ring, and had been carried in an oblique direction downwards and forwards until it arrived upon the same plane, but anterior to the *axis,* to the body and transverse processes of which it became attached by the perfect bony union, whilst the posterior fragment had suffered no displacement." (p. 82.)

The following instance of fracture, without displacement of the *atlas* and *axis,* occurred in St. Thomas's Hospital, and the preparation is in the museum there:—

Case.—W. T., aged sixty-eight years, was admitted into George's Ward.

Nov. 10, 1838. Having fallen down stairs a few hours before his admission and been stunned. Has pain at the back of his neck, which is increased by pressure. All his limbs, except the left lower extremity, which still retains slight motion, are palsied. The sensibility of the whole right side of the body is morbidly acute; that of the left totally destroyed, excepting on the belly, where he feels slightly, and to which he refers a sensation of numbness when the left thigh is pinched. Next day he complained of pain in the right arm; the skin on the left side of the belly is less sensible. On the third day the morbid sensibility of the right side had diminished, and sensation had slightly returned on the left. Complains of pain in the right *hypochondrion,* and fancies his arms lie across his chest. On the following day the belly became tympanitic. On the fifth day there was slight motion of the left arm, and the capability of moving the right leg had increased; but he was rapidly sinking, although in good heart, and died, late at night. On *examination* it was found that the *atlas* was broken in two places, the line of fracture being diagonal, and traversing the left vertebral hole. The pivot of the *axis* was broken off at its root, and a small piece of the body also. The fifth *vertebra* was fractured through the body. With neither fracture was there sufficient displacement to produce pressure. On cutting through the spinal cord, a central cell was found containing a small quantity of blood, and the substance of the cord broken down and disorganized, opposite the fifth *vertebra.*

On the other hand, dislocation of one *vertebra* from another, either partial or complete, may occur without fracture, but is so extremely rare, that, as regards dislocation of the body, **Delpech** (*b*) entirely denies it; **Abernethy** (*c*) declares:—"There can be no dislocation (of the *vertebræ*) surgically speaking—we do not take the word in its etymological sense; in surgical language, a dislocation is a displacement of bone, with a laceration of ligament unaccompanied with fracture, for if there be a fracture it is not a dislocation; but from their position, if one *vertebra* be knocked in, its articular surfaces must be broken." **Astley Cooper** (*d*) says:—"If luxation of the spine ever does happen, it is an injury which is extremely rare, as in the numerous instances which I have seen of violence done to the spine, I have never witnessed a separation of one *vertebra* from another, through the intervertebral substance, without fracture of the articular processes; or if those processes remain unbroken, without a fracture through

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(*a*) **Astley Cooper's** Lectures, vol. ii. p. 8.

(*b*) Précis Elémentaire des Maladies réputées Chirurgicales, vol. iii. p. 42.

(*c*) MS. Lectures.

(*d*) Above quoted.

the bodies of the *vertebræ*." (p. 539.) And Boyer (*a*), without actually denying the possibility, seems to infer the impossibility of such an occurrence. Exceedingly rare, however, as these accidents are, there is no doubt that they do sometimes happen, although I do not believe that a tithe of the so-called dislocations are dislocations at all; as, for instance, a person thrown from his horse, and falling on his head, has it bent under him, and cannot of himself restore it to its proper place, or he may fall from a ladder, as in a case within my own knowledge, and the neck be twisted with the face over the shoulder, and unable to be replaced without assistance; but, as Abernethy says, "this is not dislocation; it is nothing more than we are sometimes ourselves doing, the muscles are overstretched, and cannot act, the head is put in its proper place, and all becomes right." I must confess that I at first thought of like character were the cases quoted by Boyer, the one mentioned by Desault in his Lectures, of the advocate who dislocated his neck, merely by turning his head suddenly round to see who was coming into the room behind him; and the other shown by Chopart, of the young man in whom a similar accident happened from extreme rotation of the head, leaving it permanently inclined over the left shoulder; as also Rust's case (*b*), in which, after a severe fall on the head, the neck was completely bent to the right side, the upper extremities paralysed, and accompanied with repeated attacks of convulsions and hiccough, in which replacement was immediately effected by seating the patient on the ground, and forcibly drawing his head straight upwards. Since reading Schuh's case (*c*), which will presently be given, I feel sure that these were cases of actual dislocation, and that the latter was, as well as Schuh's case, reduced, although this could not be done in two other cases quoted by Boyer, as also mentioned by Desault in his Lectures, in one of which a boy, by turning heels over head, dislocated the right lower articular process of a cervical *vertebra*, and the head being turned towards the left shoulder, was so firmly fixed that it could not be replaced, although considerable force was used; whilst in another case, where one of the articular processes of a cervical *vertebra* was dislocated forwards, the child was destroyed during the attempts at reduction.

The dislocations, entire or partial, of the *vertebræ*, which are referred to by Lawrence (*d*) as dislocations, are, two of the four in St. Bartholomew's museum, displacement with fracture; the third appears to me neither dislocation nor fracture, but simply a stretching of the capsular ligaments of the articular processes, as his own description proves; "the inferior articular processes of the fifth cervical *vertebra* are partially separated from those of the fifth having been drawn upwards; but they have not been thrown forwards. The bodies of the same *vertebræ* are partially separated behind, but they *preserve their natural level and relative position in front*." (p. 392.) A case of this kind occurred under my own care, in which the lower end of the second cervical *vertebra* was separated from the intervertebral substance so far that a shilling laid flat might be thrust between them, but there was no displacement. In this case there were no symptoms of injury of the spinal cord, although there was effusion of blood between it and its covering of *dura mater*. The boy had fallen on a post, died on the fourth day, having exhibited symptoms of severe injury in the belly, and on *examination*, his liver was found broken in two. Lawrence's fourth case is a complete dislocation of the fourth from the fifth cervical *vertebra*, and a most remarkable case it is. The patient, a young man of twenty-two years, whilst "carrying a heavy barrel on the back of his head and neck, slipped in descending some steps and fell on the buttocks, the burthen resting on the head and upper part of the neck. He was immediately deprived of sensibility in the trunk and limbs, and of all power over the voluntary muscles of those parts. When brought to the hospital he was completely insensible and incapable of voluntary motion below the neck." On the following day, "there was pain in the lower part of the neck. He could move the arms very slightly, and had a little feeling in the front and upper part of the chest." On the third day, "he experienced a tingling sensation in the hands, and was sensible to impressions on the upper part of the arms and thighs." He continued to decline, and died very early on the morning of the fifth day. On *examination*, "after cutting away the muscles from the back of the spine, the cartilaginous surfaces of the superior articular processes of the fifth cervical *vertebra* came into view, in consequence of the inferior processes of the fourth *vertebra* having been completely dislocated forwards, and remaining fixed in their unnatural position. The yellow ligaments connecting the *laminæ* of the two *vertebræ* were torn through, and the bifid apex of the fourth spinous process lay in close contact with the basis of the fifth. On the front of the

(*a*) Traité des Maladies Chirurgicales, vol. iv. chap. iv. art. iv.

(*b*) Medicinisch-chirurgiche Zeitung, vol. iii. p. 127. 1813.

(*c*) Einige Fälle von Luxationen und Brüchen an der Halsgegend den Wirbelsaule; in von Raimann's Medicinische Jahrbücher des kais. kön. Oesterreichischen Staates, vol. xxi. New Series. 1840.

(*d*) Above cited.

column an unusual projection was observed, but the anterior longitudinal ligamentous expansion was entire. The body of the fourth was completely detached from that of the fifth *vertebra*, the connecting fibro-cartilage being torn through, and the body of the former projecting by its whole depth in front of the latter." (p. 394–97.) I have taken the opportunity of examining this preparation, and as it at present appears in its dry state, the right articular process of the fourth *vertebra* rests in the concavity between the transverse process and the body of the fifth; but the left process, although displaced, is not thrown completely off the corresponding articular process of the fifth *vertebra*.

Of the partial dislocation, in which only one articular process is thrown before the corresponding one of the *vertebra* below, and the body of its own *vertebra* on that side projected forward, is the instance in St. Thomas's Museum already alluded to of the right lower articular process of the axis, but of which unfortunately there is not any history. SCHUH's case (*a*) appears to me one of this kind, and the following is his account of this very interesting

CASE.—F. H., twenty-four years of age, whilst engaged in his occupation of needle-making, being suddenly called by a fellow-workman for the purpose of frightening him, turned sharply round, and at the very moment felt a crack in his neck and could no longer move his head. On the following day he came to the hospital, with his countenance turgid, his head twisted to the right side and brought nearer to the shoulder; upon the left side the neck was a little arched, and on the right rather hollowed. He had pain, increased by pressure, on the left side, from the third to the fifth *vertebræ*; and every attempt to give the head and neck another direction was vain and painful. The direction of the upper spinous processes could not be closely followed with the fingers, but the neck muscles were not by any means morbidly stretched. The patient complained of weakness in the right upper extremity; could only lift it with exertion, and had much less power of closing these fingers than those of the left hand. Attempts were immediately made at replacement by lifting the head directly upwards by the chin and hind-head, the shoulders being fixed whilst the patient sat on the ground, but in vain. This was repeated in the evening without result, and both times without pain. Leeches and cold applications were used. Two days after the patient complained of the addition of weakness in the right arm, with the sensation of its being asleep. To gain more power, the mode of reduction was varied. The patient was laid on his back in bed, with the shoulders fixed by two folded cloths, and extension made by a towel which I carried under the jaw, whilst the pulling was kept up by an assistant who held the back of the head with both hands. After gradual strong pulling the patient felt, and afterwards the assistant also, a crack or snap, and after the extension had been continued the head and neck were restored to their proper position, and could be moved in every direction, although with pain on the left side of the neck. * * * In a few days after the patient was quite well. (p. 547–49.) It is of course impossible to say that in this case there was no fracture of any part of the transverse or articular processes of the *vertebræ*, as sometimes happens.

These are all the simple dislocations I know of, and I fully agree with the reason assigned by LAWRENCE for their occurrence specially in the neck. "The greater mobility of the individual bones," says he, "the comparative smallness of their bodies, and the obliquity of their articular processes, point out the cervical *vertebræ* as most likely to be luxated; at the same time the form of the neck, and its connexion with the head, are favourable to the application of such violence as may induce luxation." (pp. 389–90.)

I have introduced the consideration of dislocated *vertebræ* here, because it is so commonly accompanied with fracture, and because the effects upon the spinal marrow are so similar in both cases, that the two subjects cannot be conveniently treated of apart. But it would have been much better had CHELIUS placed the whole subject immediately after Injuries of the Head, with which it is closely connected.

The time which persons live after fracture and displacement of the *vertebræ* varies considerably according to the situation of the injury, but even when nearly the same part is injured, one patient will live much longer than another, doubtless on account of the less or greater injury of the spinal cord. In general the higher be the injury, the more quickly is the patient cut off. ASTLEY COOPER says, that "in fracture with displacement above the fourth cervical *vertebra* the person generally dies on the instant, because the diaphragm is paralysed." This, however, is not correct, for the spinal cord is not always sufficiently compressed to cut off the nervous influence from that muscle. I have seen several cases live two or three days, or more; and PHILLIPS's case lived above forty-seven weeks. So far as I have had opportunity, I should say, that in fracture of the cervical *vertebræ*, the patient dies earlier or later within a week; in that of the

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(*a*) Slightly mentioned in the preceding page.

dorsal, from one to three weeks; and in that of the loins, in two, four, or six mouths, or he may live for two or three years, as mentioned by **Cooper** and **Brodie**.

Sometimes if a patient live long after fracture of the spine, a false joint is formed, of which there is a remarkable example in the Museum of the Royal College of Surgeons of England; the arch of the third lumbar *vertebra* has been broken, and the separated portion having dropped, has formed a false joint with the margin of the arch of the fourth lumbar. Unfortunately there is not any history to the preparation. It not unfrequently happens that if the patient with fractured spine live many months, the injury is partially repaired by ossification, producing a broad band or splint from the edge of one to that of the other *vertebra* across the front of the intervertebral substance, similar to that not unfrequently observed in old people. An instance of this kind is in St. Thomas's Museum, in which, the patient having lived five months and nine days, ossification had thus taken place between the last dorsal and the first lumbar *vertebra*, the former of which, with its arch fractured, having been displaced forwards with fracture of the front of the latter. In the Museum of the College of Surgeons there is also a preparation in which the twelfth dorsal had been completely smashed, but the pieces had united and there is a splint in front with great angular curvature forwards. Its history is unknown.

Sometimes without any fracture or displacement, after a severe blow, and without any immediate symptoms of concussion or compression of the cord, to distinguish which from each other, we have no means, except in the quick subsidence of those in the former, and the absence of distortion of the spine, the patient is seized with severe pain in his back, and becomes paralytic. Such a case is described by **Astley Cooper** (*a*), and on "opening the spinal sheath milky fluid was found within it just above the *cauda equina;* and higher than this, for the space of three inches, the spinal marrow was ulcerated to a considerable depth, and was in the softened state which the brain assumes when it is rendered semifluid by putrefaction." (p 561.)

Brodie doubts (*b*) that the process of softening and dissolution of the spinal cord after concussion is the result of inflammation, as held by some writers, and observes, that "there is a manifest resemblance between the softening of the spinal cord, which follows mechanical injury, and that softening of the brain and spinal cord which takes place from internal causes, and which was first particularly described by M. **Rostan** under the name of Rammollissement du Cerveau." (p. 126.) The whole of this paper of **Brodie**'s is well worth a careful perusal.—J. F. S.]

614. The *diagnosis* in fracture of the body of a *vertebra* is always doubtful, because on account of its deep situation, it cannot be thoroughly examined, and because the just mentioned symptoms of palsy and so on may be produced merely by severe violence without fracture.

615. If one or more spinous processes be broken and displaced, they may be replaced by the fingers; a compress is to be applied on each side, which should be fastened with a broad bandage (*a*).

In fracture of the bodies of the *vertebræ*, the *treatment* can only effect the removal of the dangerous symptoms, as every attempt to set the fracture, even in well determined diagnosis, is to be considered most highly dangerous (*b*). Repeated general and local blood-lettings, proportionate to the age and constitution of the patient, dispersing bathings, and so on, are to be employed to diminish the inflammation. The urine collected in the bladder should be frequently drawn off with the catheter, because it soon decomposes and acts injuriously on the walls of the bladder. Volatile infrictions are to be made on the distended belly as well as on the palsied limbs, to which infrictions of tincture of cantharides may be added. If with the fracture there be injury of the soft parts, as shot wounds and so on, we must endeavour to remove the loose splinters of bone by incision. If the patient improve, he must be supported with strengthening remedies, and with the use of strengthening baths for the improvement of his health. If after previous injury of the spine symptoms of chronic inflammation continue, continued issues in the neighbourhood of the spine are the most proper remedies.

(*a*) On Dislocations.

(*b*) Above cited.

[(*a*) If the unnatural mobility of one or more spinous processes lead to the fair presumption of their fracture from the vertebral arch or arches, but unaccompanied with symptoms of injury to the spinal cord, it is better to leave them alone and merely apply a few leeches. But if symptoms be present, then it may be suspected that there is further mischief, and it will become a question as to the propriety of proceeding to an operation for their relief.

(*b*) The attempt to set a fracture through the body of a *vertebra*, accompanied, as it almost invariably is, with displacement, and most commonly with fracture of the vertebral arch, or articular processes, is, as CHELIUS says, most highly dangerous, and ought never to be attempted. BRODIE, however, thinks differently, and says, "there can be no doubt, that when the injury is in the lower part of the spine, the attempt to effect reduction may not only be made with impunity, but that it may be successful." (p. 159.) And he quotes the case of a man upon whom a mass of chalk fell. "Mr. HARDWICKE, of Epsom, being sent for, found the first lumbar projecting over the last dorsal. With some difficulty he reduced the displaced *vertebra* to its natural position; the reduction (as I was informed) taking place with a jerk or snap:" he was afterwards admitted into St. George's Hospital, and then had "some power of using his lower limbs whilst in bed, but he could neither walk nor stand, and he was unable to empty his bladder without the aid of a catheter." (p. 157.) In another case where the fracture was between the third and fourth lumbar, BRODIE "endeavoured, by fixing the *thorax*, and cautiously extending the *pelvis* to restore the *vertebræ* to their proper place. The attempt was, in some degree, successful, and no ill effects, of any kind, resulted from it." (p. 159.)

I must confess that HARDWICK's case does not appear to me satisfactory, as the patient was in precisely the same circumstances as a person with this accident for whom nothing has been done. He lived two or three years without improvement, which is the ordinary history of these cases; though, after the first few weeks, they, for a time, seem to be recovering sensation and motion, but beyond a certain point they do not mend. I fully agree with CHELIUS, that it is better not to attempt any reduction; the only mode in which it can be possible, as seems to me, is by bending the body forward, so that the displaced arch may be put into the same position as at the time of the accident, and then rise over the arch beneath it; the old method, therefore, of stretching over a barrel, is certainly the most proper mode of attempting the reduction, if it be attempted at all.

The only remedies, practicable, are the palliative treatment here proposed, by which it is hoped to accommodate the spinal cord to its unnatural position and to the pressure to a greater or less extent made, by keeping down the inflammatory disposition, but which does not materially relieve the palsy and restore the functions of the parts below the injury—or by an operation to remove the compressing vertebral arch; a subject which will be presently considered. If the case be a compound fracture, which can scarcely happen in any other way than by a ball or bullet, then the loose pieces should, as CHELIUS recommends, be removed.—J. F. S.]

616. In fracture of the *vertebræ* with inpression, as in similar injuries of the skull-bones, it has been recommended to lay bare the injured part with an incision along the spinous processes, and separating the muscles on their sides, to remove the arch of the injured *vertebra* with a small trepan-crown, or with HEY's saw (HEINE's osteotome would be best.) This operation has been performed by the younger CLINE (1), WICKHAM, ATTENBURROW, TYRRELL (*a*), HOLSCHER, SMITH, and ROGERS; but the result in every case was unfortunate. Experience has not, therefore, yet contradicted the opinion given by CHARLES BELL (*b*), which is directly opposed to ASTLEY COOPER's (*c*), in reference to trepanning the spine; and it is only to be considered as a means of alleviating the patient's condition. JÆGER, however, thinks that, as after this operation, there is not any aggravation, but rather in most cases immediately improvement, with restoration of motion, although in no case has there been an entire cure, the case calls for the performance of the operation in decided inpression and palsy,

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(*a*) TYRRELL's second and also fatal case in the Lancet, vol. xi. p. 685. 1827.

(*b*) Above cited, p. 23.

(*c*) COOPER, A., On Dislocations, p. 559.—Lectures, p. 11.

rather than for its refusal, but especially soon after the accident and before inflammation has set in (*a*).

[(1) The operation for the removal of the pressing vertebral arch, was first proposed and performed by the younger CLINE, in the spring of 1814, and though unsuccessful, showed the practicability of such an operation; and in the following year he gave a lecture explanatory of his views on the subject, my own notes of which are unfortunately missing; and though I have taken considerable pains to obtain notes from pupils attending the hospital at that time, I have not succeeded in meeting with any, except the brief account of the case from our Museum book, and the short notes of my friend JOHN WALLACE, of Carshalton, for which I have to thank him.

CLINE considered, and very justly, as is amply proved by examination of these cases, that the symptoms resulted from the pressure of the spinal cord by the spinous process of the displaced *vertebra*, either fractured or not, a condition which he thought analogous to that of the brain when a piece of the skull is driven in upon it, and causes symptoms of compression, but which are relieved by the removal of the cause of the compression. With this notion he held it feasible to remove the compressing vertebral arch, and so to relieve the palsy. And for this purpose he operated in the following

CASE.—A. B. was admitted into St. Thomas's Hospital

June 15, 1814. Having fallen from a window two stories high into a ditch containing little water, and received an injury, with displacement of the spine, for which the medical man by whom he was first seen bled him, and attempted to replace the bones by the pulling of five or six strong men, which, however, as might have been expected, not succeeding, he was sent to the hospital.

June 16. It having been determined to take out the compressing vertebral arch or arches, the man was brought upon his bed into the operating theatre, and carefully put upon the table with his face downwards. An incision was made through the skin over the projecting spinous processes, and of sufficient length to expose them completely. The muscles were then divided on each side, and being drawn outwards two spinous processes, which were broken at their roots, were removed. It was attempted to remove the vertebral arch by sawing it through with MACHELL's circular saw, which was ineffectual; a chisel and mallet were then employed, and also a trephine, by means of which the separation was effected and the arch lifted out with an elevator. The operation was considerably embarrassed by the unfitness of the instruments, and occupied a considerable time, but was not accompanied with much suffering. In the *evening*, he was tolerably well, but complained of pain in the wound. Pulse 114.

June 17, 2 *p. m.* Has not had any sleep since the operation: nor any relief from the bowels; tongue white; skin perspirable; pulse 130. At 6 *p. m.* he had a fit and was thought to be dying.

June 18, 1 *p. m.* Had another fit; has great difficulty of breathing, with much nervous irritation. Pulse 140. The upper part of the body is in a cold sweat; the lower part warm, but not perspiring. The bowels have been relieved. Has been taking fever mixture, with five drops of laudanum, which was ordered to be increased to fifteen drops, and given hourly, if the dresser thought necessary. At 4 *p.m.* the spasms had abated, and he was better.

June 19. Through the morning he was more tranquil, but gradually sunk, and at 5 *p. m.* died, without convulsions and sensible to the last.

On examination. The fore and upper part of the body of the twelfth dorsal *vertebra* was found to be fractured obliquely from above and behind, downwards and forwards. The upper portion of this *vertebra* continued attached by the intervertebral substance to the eleventh dorsal, which had moved forwards and a little downwards, tearing away the hinder half of the intervertebral ligament from the top of the twelfth *vertebra*. By this projection the arch of the eleventh had compressed the spinal cord between itself and the back of the body of the twelfth dorsal *vertebra*. In the sheath of the cord were four lacerations opposite the injury, two of which would admit the little finger. The spinal marrow was three-fourths torn through, and the remaining portion was bruised.

In the clinical lecture which CLINE delivered, he explained the reasons that had induced him to perform this operation, and the grounds upon which he hoped for success. He considered that, " in fracture with displacement of the *vertebræ*, which compressed the spinal cord, this great nervous cord was under precisely the same circumstances as the brain when pressed by fractured skull, and that, therefore, as the elevation of the pressing bone was indicated in the latter case, and often effected with success, so was it equally called for in the former, and that no positive reason could

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(*a*) HAMMICK's Practical Remarks on Amputations, Fractures, &c. London, 1830. p. 192.

exist why the operation should not be successful, provided the injury of the spinal cord itself were not great, a condition which, as regarded the brain, would equally forbid operation, or render its success improbable or impossible." The spinal cord may be simply compressed, (as in **Tyrrell**'s first case,) or it may be more or less torn, without or with injury to the spinal sheath (as in **Cline**'s case just recited, and in that on which I operated); or blood may be effused into the spinal canal, within or without the sheath, either at one spot or to a considerable extent, or it may be poured into the substance of the cord itself, and have the appearance of blood in an apoplectic cell.

The result of **Tyrrell**'s case (*a*), which was certainly most favourable for operation, the cord not having been subjected to other injury than pressure, was most highly encouraging, and I cannot but think that if the after treatment had been different he would probably have recovered. In **Cline**'s case the cord was so much torn, and in my own so completely torn, and the sheath in both so rent, that their exposure by the operation at once showed the utter hopelessness of relief in either case. **Cline** candidly stated that he thought the operation had hastened his patient's death.

Before undertaking the operation of cutting out that part of the arch of the *vertebra* which compresses the cord, **Cline** proposed to himself "four questions:—1st, Will the patient die of the operation? Probably he will, if the injury be severe. [I do not exactly understand the answer given, for there is no danger in the operation, if it be performed with care; but I suspect that he thought the exposure of the cord might hasten inflammation, and so death might more quickly result.—J. F. S.] 2nd, If the cord be much hurt will it recover its functions? This is unknown; but we do know that if a nerve be divided it will unite, and the greater part of the spinal cord may be divided in a brute and yet the animal recover; in proof of which he detailed an experiment which he performed on a bitch. A cut was made at the back of the neck through the muscles and the yellow substance between the last cervical and first dorsal *vertebra* having been divided, the handle of a scalpel was pressed firmly down on the cord, and the result was, that the parts behind the division were completely palsied, excepting that the tail continued still capable of a very slight motion, proving that a small portion of the cord was still undivided. With very great care and attention, the animal recovered after some months, and resumed all her paces as usual, with the exception of a peculiar movement of her hind limbs in galloping. She was afterwards destroyed, and the spinal cord being examined, was found to have united. [In what condition it was found the notes do not state, but as far as my recollection serves, without any very remarkable external appearance being observed.—J. F. S.] This then seemed to be sufficient proof that a spinal cord which had been considerably injured, if not all but entirely torn through, might be re-united and recover its functions. 3rdly, After the removal of the arch of the *vertebra* will the spine be sufficiently strong to support the body? Probably it will for ordinary purposes, though the patient may not be able to lift heavy weights. 4thly, Will a patient recover from a compound fracture of the spine, which, by the performance of the operation, it becomes? The nearer a fracture is to the source of the circulation, and the less compact, and consequently the more vascular the bone is, the greater is the probability of recovery. Both these advantages are present in the spine, and therefore favour the successful issue of the case."

Such is the very brief account alone which I am able to give of **Cline**'s notions in reference to the removal of the compressing portion of the vertebral arch or arches. I regret especially that I have been unable to procure the details of this experiment upon the dog. But as no account whatever has been hitherto published of this first operation, or of the observations of the operator in reference to the subject, I have thought it right to give these details, meagre as they are, rather than to allow their being entirely lost and forgotten.

As might be expected, the case at the time excited considerable interest, and Surgeons were much divided in opinion as to the probability of any successful result. **Astley Cooper**, however, thought so well of it that within a few months he operated on a case in which there was supposed to be fracture with displacement; it turned out, however, to be merely a fracture of the spinous process of a dorsal *vertebra* at its root, and therefore the arch was not meddled with. I saw the operation performed, but I do not recollect how the case terminated. In referring to **Cline**'s and **Tyrrell**'s cases, **Cooper** observes, "whether future trials will be more successful, it is difficult to say; we cannot speak decidedly on the subject, as the first operations have been unsuccessful. The proposal is laudable, and the operation is not severe, nor does it increase the danger of the patient; time and experiment can only determine its value. If we could

(*a*) His edition of A. **Cooper**'s Lectures on Surgery.

save one life in a hundred by it, we should deserve well of mankind; and if any good does ultimately result from it, HENRY CLINE has the merit of proposing it." (p. 11-16.)

ABERNETHY, in speaking of the same subject (*a*), says: — "I certainly would not do it (the operation of removing the vertebral arch) at first, as I should then expect to have not only the inflammation from the accident, but have it increased by the inflammation of the operation. I would wait as in cases of fracture with depression of the skull, till the first inflammation has subsided. I think that it is a proposition too hardy to be acquiesced in; but I see nothing in it but what is rational, it is the only mode that occurs to one's mind.

The testy observations of CHARLES BELL are of little value; he must have well known that the proposal of this operation originated with the younger CLINE, though he has chosen to say that ASTLEY COOPER "proposes to trepan and raise up the depressed bone." (p. 77.) His sneering question and corresponding answer—"if the ring of the *vertebra* be broken down where is the necessity for applying the trephine? You have the projecting spinous process; you have the inferior and superior edge of the bone on which to place your elevator or to lay hold of with your forceps. I cannot for the life of me imagine any reason why that ring of bone should be trephined, and in two places," (p. 20,) may be easily dealt with. He might have known that the vertebral arch itself was not always broken either on both or one side, but that either the articular process or processes of the *vertebra* below were broken off, and the arch of the compressing *vertebra* allowed to drop into the notches for the passage of the nerves, or that without any fracture of those processes, the arch might be lifted over into those notches, or that simply by the falling forward of the upper *vertebra* in consequence of the fracture of the body of that below it, the cord might be compressed by the curvature so produced, just as happens when the upper part of the spine falls forwards in caries. As to the objections about "the degree of violence necessary to the accomplishment of the operation," and that "the man must be already dead whose condition is not made worse by such an operation as this!" (pp. 21, 22,) I can only say that in TYRRELL'S operation, which I witnessed, and in that which I performed, no violence was either required or used; in neither did the patient suffer much; nor was his condition rendered worse, but in TYRRELL'S case immediately improved. The object of BELL'S attack on this operation must be referred to his angry feeling towards COOPER, the wrathful expression of which in print, is deeply to be regretted, even had there been sufficient cause. Nor should I have referred to him at all, had he not unjustly given to one person that which belonged to another, so as more efficiently, as he thought, to empty on him the vials of his wrath.

BRODIE is certainly not favourable to this operation; for, he observes:—"If the whole or nearly the whole, of a *vertebra* be driven forwards, the depression of the posterior part of it will of course occasion a diminution of the spinal canal; but the removal of any portion of the *vertebra* which is accessible to an operation will be of little avail, as the irregularity in the anterior part of the canal, made by the displacement of the body of the *vertebra*, must be the same after, as it was before, the operation." (p. 160.) TYRRELL'S case, however, entirely disproves this opinion, as regards the edge of the vertebral body; for immediately the pressing arch was removed, the man had feeling in the thighs, and which gradually extended further, although previous to the operation all the parts below the fracture were completely devoid of sensation. BRODIE continues:— "If there be simply a fracture on each side of the spinous process, with a depression of the loose or intermediate portion of bone, of course there must be a corresponding diminution of the size of the vertebral canal; but as that canal is much larger than the spinal cord which it contains, it does not follow that the spinal cord is really compressed, or that any material diminution of the symptoms would follow the elevation of the depression" (p. 160.) To this it must be answered, that the operation would of course never be thought of unless symptoms of compression existed, and the sort of fracture of the vertebral arch, which BRODIE mentions, would not be likely to cause them. But in most of the cases I have seen, the fracture has been either through one or both articular processes, or one side only of the spinous process, or the compression has been caused without any fracture of any part of the arch, simply by the body of one *vertebra* falling forward before that of the one beneath it, and of which the upper and fore part had been torn off, and thus a compressing curvature of the spine produced, as in *caries*. His objections, therefore, do not apply to the kind of injury for which the operation is proposed.

The only reasonable objection to the operation of trephining the spine is, that we cannot, previous to the operation, ascertain whether the spinal cord be simply com-

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(*a*) MS. Lectures.

pressed, or whether it be partially or entirely torn through, or whether the symptoms of compression result from the effusion of blood in the different situations above mentioned, neither of which indeed can be ascertained after the vertebral canal has been opened, unless the sheath be rent. If, however, this objection hold in regard to the fracture of the skull with symptoms of compression, for no one can certainly determine what mischief may be beneath the fractured bone, and even if it be seen, as occasionally it may be, that the membranes of the brain are torn, and a portion of the brain itself squeezed out, yet if the bone be depressed, and the brain labours under pressure, no one would hesitate to remove the bone, in whatever condition the brain beneath might be expected to be found. This treatment of a compressed brain, with symptoms of compression, being that which is thought necessary by all Surgeons of experience, it seems to me that the analogy is so close, as regards compressed spinal cord, that the operation is not merely permissible, but is called for imperatively, and I fully agree with **Jæger**, that the earlier it is performed, the better. The much dreaded subsequent inflammation I do not think is much to be feared; at any rate it is never taken as an objection to trephining the skull. The great difficulty in the after-treatment is the great irritability of the bladder from the highly alkaline state of the urine, which depends on the irritation of the cord, but which I doubt not might be counteracted.

Operation.—The operation is tedious and tiresome, unless the muscles can be well drawn aside from the spine. A long incision should be made along the ridge of the spinous processes, the middle of which should be opposite the displacement, and from them all the muscles should be well cleared. **Cline** and **Tyrrell** used broad angular plates as retractors on each side, but they are very inconvenient. Instead of employing them, I divided all the attachments of the muscles to the articular processes, which gave plenty of room, as the one end of each muscular bundle being separated from its attachment, it retracted of itself, and needed little holding back with the finger. **Cline** advised the use of a small crowned trephine to cut through the vertebral arch, if requisite; **Tyrrell**, however, found **Hey's** saw most convenient: but, in my case, one side of the arch being broken, and the yellow ligament torn through, and admitting the entrance of my finger, I divided the other side of the arch with a pair of stout bone-nippers. I should therefore think that generally the saw or the nippers would be found sufficient; but in an operation of this kind the Surgeon must remember that he must be ready to use one instrument or another, according to the circumstances of the case. In sawing or cutting out the arch, it is always best to grasp the spinous process, if it be not broken, with a pair of stout tooth-forceps, and I think these are to be preferred to the elevator for lifting the detached bone from its natural connexions. If, when the vertebral canal has been thus exposed, there be any clotted blood upon the sheath, it must be gently removed with the end of a probe or director. And if the cord be not torn through, its pulsation will be seen to return so soon as the pressure on it has been removed.

After the operation and dressing the wound with long straps of adhesive plaster, the patient should either be kept on his face, or by means of **Knox's** spine-bed (*a*) may be replaced on his back, and from day to day turned over, the state of the wound examined, the dressings readjusted, and after resting a few hours on his belly, again be turned upon his back. The bladder will require to be frequently emptied with the catheter, which is better than allowing it to remain in continually.—J. F. S.]

(*a*) **Knox**, upholsterer, of Jermyn-street, has constructed an ingeniously-contrived bedstead, applicable specially to injuries and diseases of the spine. Its ground-work is **Henry Earle's** bedstead, and has at each side a deep plank, presenting the appearance of a large oblong table-tray. In the middle of the frame, at the head and foot, is a large pivot on the same plane as the bedstead, which rest each in a socket upon a strong wooden frame within which the bedstead swings. The foot pivot is longer than its socket, and has attached to it a cogged wheel with handles like a rudder-wheel, and traverses vertically by handles ranged round its edge, and which as it is turned, on drawing back the catch which bolts into the cog-wheel, can incline the bed from side to side, or even turn it completely upside down. In order to turn the bed over, one long well-stuffed pillow is inserted between that side of the patient on which he is to rest in turning and the corresponding side of the bed. The space between the other side of the bed and the patient is then to be packed with other pillows, after which a hair mattress, extending from the patient's chin to his heels, is laid upon and some stout bands crossed and buckled over it from one edge of the bed to the other. The preparations being now perfected the winch is turned carefully; in a few minutes the patient rests upon his belly, and immediately the original bottom of the bed, which is supported by bolts, is removed, the pillows taken away, and thus the whole back exposed, without the patient's position having been in the least disturbed. Return to the supine posture is effected by adjusting the pillows and reapplying and bolting in the original bottom, and turning the cog-wheel in the opposite direction. I have used this bed several times, and found it very useful, though rather cumbrous.

VII.—OF FRACTURE OF THE PELVIC BONES.

(*Fractura Ossium Pelvis*, Lat.; *Bruch der Beckenknochen*, Germ.; *Fracture des Os du Bassin*, Fr.)

Creve, C. C., Dissert. de Fracturis Ossium Pelvis. Mogant., 1792. 4to.

Ibid, Von den Krankheiten des Weiblichen Bechens. Berl., 1795. 4to.

Swan, Joseph, On Injuries of the Pelvis; in Med.-Chir. Trans. vol. xii. p. 520.

Adelmann, D. G., Dissert. de Fracturâ Ossium Pelvis. Fuldæ, 1835.

Cooper, Astley, On Dislocations, and on the Fractures of Joints.

Earle, Henry, Observations on Fractures of the Bones of the Pelvis; in Med.-Chir. Trans. vol. xix. 1835.

617. *Fracture of the Pelvic Bones* is rare on account of their great strength, deep situation, and thick covering; it therefore always requires very great violence, by which most commonly severe injury to the soft parts is produced; or the same symptoms as in fracture of the spine, may be caused by injury of the spinal marrow. The fracture may happen to the *rump-bone*, to the *coccyx*, to the *hip*, *share* or *haunch bone*.

618. *Fracture of the Rump-bone*, (*Fractura Ossis Sacri*, Lat.; *Bruch der Heiligenbeines*, Germ.; *Fracture du Sacrum*, Fr.,) at its upper part, is unconnected with any displacement, therefore the *diagnosis* is generally difficult; but if it happen at the lower part, the lower piece is displaced inwards, (forwards,) and for its replacement the finger well oiled must be introduced into the *rectum*, and press the bone outwards (back.) A thick compress, moistened with a dispersing lotion, must be applied on the rump-bone, and fastened with a broad bandage surrounding the whole *pelvis*. The rest of the treatment is the same as in fracture of the *vertebræ*, and must be directed against inflammation of the pelvic intestines, and the symptoms of palsy of the spine or of the sacral nerves.

[This is an accident of very rare occurrence; there is, however, in the College Museum, an example of vertical fracture of this bone. The patient died of suppuration six weeks after the accident, and there was not any union.—J. F. S.]

619. *The Coccyx* (*das Steissbein*, Germ.) rarely breaks, on account of its great mobility and deep situation. It happens specially in old persons, in whom the connexions of its several pieces have become ossified. The cause is usually a fall upon the rump, consequent on which fixed pain occurs in the region of the *coccyx*, which is increased in walking; and distinct motion of the ends of the fracture is felt. If the under piece of bone be driven in, (forwards,) it must be replaced by introducing the finger into the *rectum*; a moistened compress is then to be applied over the seat of fracture, which is to be fastened with a T bandage, and the general treatment is to be directed according to the accompanying symptoms.

[This accident, commonly so called is, I suspect, rather a tearing of the ligamentous expansion in which the several pieces of the bone are enclosed, the bony pieces themselves being too small and too spongy to break, except squeezed between two hard substances, which is scarcely possible. Though seemingly a very trivial accident, it is often exceedingly painful and annoying for many months; indeed, I have known two cases where it was not recovered from for nearly two years; the one followed sitting down suddenly on the edge of a snuff-box, which jammed in between the side of the *coccyx* and the spine of the haunch-bone; and the other, by the patient having been thrown from a horse upon a heap of stones. In these cases the pain was not so great as usually said to be, in walking, because the patients learned to walk without disturbing the bone; but the pain was agonizing when they incautiously sat down on a soft seat. Leeching afforded only temporary relief; and the cure was at last effected, after months, by protecting the *coccyx* from all possibility of pressure, by constantly wearing a pair of very thick oblong pads on the ischial tuberosities, so that in sitting the point of the *coccyx* was in a deep pit.—J. F. S.]

620. The *Hip-bone* (*die Darmbeine*, Germ.; *l' Os des Iles*, Fr.) is more exposed to fracture than the other bones of the *pelvis*. The direction of the fracture varies; sometimes only one, sometimes both hip-bones are broken, or even the *share* (*das Scham-*) and *haunch* bones (*das Sitzbein*, Germ.) Only much violence, as a fall from a great height, or being run over by a heavy waggon, and the like, can produce these fractures; therefore they are always accompanied with severe bruising and tearing of the soft parts, and with symptoms of concussion of the spinal marrow and of the sacral nerves.

[I have seen several cases of fracture of one or other portion of these bones, but I do not recollect any one in which symptoms of concussion of the spinal cord existed. The most obvious circumstance is the great collapse which generally accompanies the accident, and which depends rather on the tearing or bursting of the bladder usually occurring in these accidents, than on the injury of the bone itself. From the same cause these fractures are almost invariably fatal; the least serious are fractures of the expanded part of the hip-bone. I have known one instance of recovery from compound fracture of the hip-bone.

621. The *diagnosis* of fractures of the hip, share, or haunch-bone is often very difficult, because the broken ends are generally not at all displaced. The slightest motion of the body and of the lower limbs causes severe pain at the seat of fracture. The fracture may often be discovered by pressure upon the hip-bone and other pelvic bones; or by its mobility, and by its crepitation when the thigh is moved. If fracture of the hip-bone extend through the hip-socket and the broken ends be separated, the thigh may be shortened, the foot and knee turned inwards, and the case may be mistaken for a dislocation of the head of the thigh-bone (1). The shortened leg may easily be brought down, by pulling, to its natural length, but retracts immediately the pulling is left off; the foot has no disposition to fall aside; in pressing on the *trochanter* or iliac crest of the injured side, deep crepitation is felt; both *trochanters* stand out equally distant from the upper anterior spine of the ilium (*a*). When the hip-bone is separated from the rump-bone and the share and haunch bones are broken, the foot is shortened, but retains its proper position. These cases are distinguished from dislocation by the crepitation, which is easily discovered on moving the thigh, and by its more free motions of the latter. If there be displacement of the ends of the fracture, elevations and depressions are felt; and also examination of the pelvic cavity through the *rectum* or the *vagina* often declares fracture of the pelvic bones. By the separation of the ends of the fracture inwards, especially if they be split, the parts in the cavity of the *pelvis* are injured, extravasation of the urine and the like are produced (2).

[(1) The discovery of fracture of the hip-bone is generally easy, by fixing the true *pelvis* with one hand, and with the other, having thrust in the fingers over the crest of the hip-bone as far into the iliac pit as the abdominal muscles will permit, attempting to move it in and out, which may be done if it be broken. In the same way, but less readily fracture of the haunch-bone may be ascertained, by grasping its tuberosity and endeavouring to move it.

Displacement in these fractures, so far as I have observed, is rarely of any great extent, and the bones are so covered by soft parts, that they would generally be overlooked, were it not that the circumstances of the accident being told, leads to an examination of the injury to determine its extent. I do not see any great advantage derived from making an examination by the *rectum* or by the *vagina*.—J. F. S.]

(*a*) Cooper, Astley, above cited, p. 105.—Fricke, Annalen der Chirurg. Abtheil. des allgem. Krankheit.; in Hamburg, vol. ii. p. 131.—Earle, Henry, above cited, p. 250.

(2) A very remarkable case of fracture of the haunch-bone, which was followed by abscess in the perineum and extensive urinary fistulæ, but which recovered after eighteen months, is related by HOUSTON (*a*).

622. If fracture of the pelvic bones be accompanied with displacement, nothing can be done except putting the patient in such position that the muscles inserted into the *pelvis* should be at rest; a broad band must be applied around the *pelvis*, and the patient recommended to keep quiet. The accompanying symptoms of inflammation or injury of the spinal marrow require the same treatment as in fracture of the *vertebræ*. If the broken pelvic bones be displaced, it must be attempted to return them to their proper place, as in fracture of the share and haunch-bone, by the introduction of the finger into the *vagina* or into the *rectum*. If by splintering of the bones the bladder be injured, and the urine extravasated, its further extension must be prevented by incision and by the introduction of the catheter.

[As I have already mentioned, displacement in fracture of either of the pelvic bones rarely occurs, and, therefore, introducing the finger into the *rectum* or *vagina* is not generally requisite.—J. F. S.]

VIII.—OF FRACTURE OF THE BREAST-BONE.

(*Fractura Sterni*, Lat.; *Bruch des Brustbeines*, Germ.; *Fracture du Sternum*, Fr.)

623. *Fracture of the Breast-bone* is rare, on account of its elastic connexion with the ribs, and on account of its sponginess. It is either consequent to severe violence which immediately strikes the breast-bone, or on violent bending backwards of the body (*b*). Its direction is generally transverse, more or less oblique, or the bone is broken into different pieces. The broken ends may be driven inwards by the violence which has caused the fracture, or the lower end, which is more raised in the motions of the chest than the upper, lies over it. From this displacement, as well as from the effect of the violence, the organs of the cavity of the chest may be variously wounded, inflammation of the lungs and of the *pleura*, spitting of blood, collections of blood in the *mediastina*, and subsequently suppuration in the breast-bone itself, or beneath it, may be produced.

624. The *diagnosis* is never difficult, on account of the superficial position of the breast-bone. If accompanied with displacement of the fractured pieces, it is easily discovered by examination; in fractures without displacement an unusual movement of the breast-bone is always observed in breathing, and crepitation, which the patient himself also perceives. A fixed pain is at the same time felt in the breast-bone, which increases on breathing; and there is much accompanying oppression, cough, spitting of blood, palpitation, and so on.

625. If the fractured ends be not displaced, a compress dipped in a dispersing lotion is to be applied on the seat of the fracture, and the motions of the chest prevented by a tightly applied breast-bandage. The patient must be kept quiet, with his chest a little raised and his head bent forwards. If the ends of the fracture be separated, they must be put right

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(*a*) Case of Fracture of the Pelvis attended with sloughing of the urethra and singularly extensive urinary fistulæ, cured by operation after the lapse of one year and a half; in Dublin Journal of Medical and Chemical Science, vol. viii. p. 11. 1836.

(*b*) CHAUSSIER; in Révue Médicale, Nov. 1827.

as soon as possible; for which purpose the patient must be much bent backwards, and a pillow laid beneath his back. If the setting cannot be in this way effected, and the symptoms are pressing, the seat of fracture must be laid bare, and the replacement of the displaced ends of the bone effected with an elevator; and if this be insufficient, the edge of the fracture must be first removed by means of the lenticular, or perforation of the breast-bone must be made. This, however, has been objected to by CHARLES BELL and others as useless, inasmuch as to the existing injury a new one is added, without advantage, which my own experience has also confirmed. If, after complete replacement, the one end of the fracture have a disposition to become displaced, it must be kept in its proper position by means of a graduated compress and breast-band, which DUPUYTREN endeavours to effect by a splint upon the breast-bone, and GÜNTHER by a splint fastened upon the chest with starch bandage. If such fracture be cured without the broken ends of the bone being brought into place, constant cough, oppression, and distressing palpitation of the heart are produced. The general treatment must be directed according to the injuries accompanying the fracture and the inflammatory condition of the organs in the chest. Collections of blood and pus behind the breast-bone render the application of the trepan necessary.

[I do not know any instance in which the severe symptoms here enumerated have occurred in fracture of the breast-bone; and I should not be disposed to perform any operation for raising the depressed end of the bone, for the reasons assigned by CHARLES BELL, and also because I should fear that the violence which would drive the breast-bone in so as to produce such severe symptoms, would have caused such other serious mischief as to render the operation useless, and therefore not permissible.—J. F. S.]

IX.—OF FRACTURE OF THE RIBS.

(*Fractura Costarum*, Lat.; *Bruch der Rippen*, Germ.; *Fracture des Côtes*, Fr.)

626. *Fracture of the Ribs* most commonly happens to the lower true ribs, as the false ribs by their mobility yield to the external violence, and the upper true ones are protected by the collar-bones. The ribs usually break at their most convex part. The cause of fracture is either violence which thrusts the ribs from before backwards, or which squeezes them inwards at their middle; in the former case the ends of the fracture project out, and in the latter inwards, by which the *pleura* or the lungs (1) are wounded, and inflammation of them, extravasation into the cavity of the chest and *emphysema* are produced. The broken surfaces are mostly oblique, and more or less uneven.

That severe cough can produce a broken rib, which has been wrongly denied, is shown by a case in the Dublin Journal of Medical and Chemical Science, 1833, July, p. 355, in which the fracture of a rib happened to a woman of forty-seven years old, during a severe fit of coughing. A pain, however, connected with displacement or tearing of some muscular fibres caused by severe cough, is not to be confounded with that just mentioned.

[(1) The heart is sometimes penetrated by the end of a broken rib, of which, in St. Thomas's Museum, there is an example in the following

CASE.—A. B. was admitted into George's Ward,

June 3, 1839, 9 A.M., having been a short time previously run over by his own cart. He was able to walk from the gate to the surgery, a distance of about a hundred yards, but complained of difficulty in breathing. The fourth and fifth ribs of the left side were found to be fractured, and a bruise of the soft parts at the same spot. He lived only nine hours, and seemed to die of suffocation. On *examination* much blood was found poured out beneath the skin covering the chest, principally on the left side; but there were also some clots on the right side. The first piece of the breast-bone was broken.

The upper two ribs on the right side were broken near their cartilages; and the upper five on the left side through their middle. The cavity of the left *pleura* contained two pints of bloody serum, and the left lung was collapsed, and torn at its apex. The sharp splintered end of one of the ribs, which had penetrated the *pleura*, had passed also through the *pericardium*, which contained a small clot of blood, and wounded the heart near its *apex*. There was a large tear through the right side of the diaphragm, but no blood in the cavity of the belly.—J. F. S.]

627. The *diagnosis* of this fracture is often very difficult, as the broken ends can project only inwards and outwards (indeed, in many cases the broken ends resume their natural position); and this displacement, especially in fat persons, often cannot be well distinguished, particularly if swelling have already commenced. The patient feels a fixed and more or less severe pain, which increases on breathing; crepitation is felt if the hand be placed on the seat of fracture and the patient bidden to cough; crepitation, and frequently unevenness of the ribs, if they be closely examined through their whole length and a moving pressure made on them. An air swelling (*emphysema*) appearing on the seat of injury is an undoubted proof of fracture of a rib.

628. The *local treatment* of fracture of the ribs consists merely in preventing their motions, by means of a broad breast-band applied sufficiently tight. If the broken ends have fallen inwards, or have an inclination so to do, a compress is to be placed on the fore and hind ends of the broken bone, and over them the chest-bandage. The especial object of this bandaging is always the restriction of the violent motions of the chest; the patient no longer hears so frequently the striking together of the fractured ends, and the pain is always much diminished. It is, therefore, improper not to apply a bandage, as recommended by many persons. The *treatment* of the patient must, in other respects, be in reference to the inflammatory condition produced by the violence itself or by the fracture. The patient should observe the strictest quiet, and must be frequently bled, and so on. A severe cough, which causes much pain, and produces displacement of the ends of the fracture, requires, with the proper antiphlogistic treatment, antispasmodic remedies, an emulsion with nitre, opium, or extract of hyoscyamus. If extravasation of blood occur in the cavity of the chest, or *emphysema*, they must be treated according to the rules laid down in wounds of the chest.

For the purpose intended a properly applied chest-band is sufficient. GRAËFE employs an elastic chest-girdle with spiral springs; LARREY, his immovable apparatus; and SEUTIN applies pasteboard splints; MALGAIGNE will prevent respiration on the sound side but not on the injured side, by sticking plaster, which passes from the seventh rib of the affected side back to the spine, and above the healthy shoulder, and terminates at the hip of the injured side. A padded pasteboard splint, according to BAILLIE, applied, with an aperture for the seat of fracture, would afford great ease.

[Although in fracture of the ribs of one side, bandaging the chest (without, however, the compresses which CHELIUS recommends in some cases to be applied) is the most proper and efficient treatment, yet, if the ribs on both sides be broken, and especially if many of them, no bandage must be employed, as the breast-bone being partially unsupported, the broken ribs slip behind each other, and being thrust into the *pleuræ*, render the patient's condition worse. The only thing to be done, therefore, is to keep the chest raised, and so supported by pillows as to keep it as much at rest as possible, and encourage breathing by the diaphragm.

When there is much and inconvenient *emphysema*, a few punctures through the skin should be made for the escape of the air.—J. F. S.]

629. The *cartilages* connecting the ribs with the breast-bone may break without being ossified. If the fracture of the cartilage be near the breast-

bone, the inner portion sticks out and crosses the outer part. The contrary happens if the fracture be far from the breast-bone, which depends on the finger-like attachment of the *m. triangularis sterni.* The *diagnosis* is easy, on account of the separation of the ends of the fracture. The *setting* is not difficult, and succeeds best if at the moment of inspiration an attempt be made to press the ends of the fracture into their place. A broad breast-band (according to MALGAIGNE, an English truss) should be put on sufficiently tight, which cannot, however, always completely prevent the displacement of the ends of the fracture, though it fixes them in place; in consequence the pain, which depends on the movements of the fractured ends, is diminished; and in this way the union is favoured, which is always perfected by a bony ring more or less surrounding the ends of the fracture.

X.—OF FRACTURES OF THE SHOULDER-BLADE.

(*Fractura Scapulæ*, Lat.; *Bruch des Schulterblattes*, Germ.; *Fracture de l' Omoplate*, Fr.)

630. The *Fractures of the Shoulder-blade* are those of the *acromion*, of the *neck*, of the *coracoid process*, of the *body*, and of the *lower angle.* These are always consequent on very severe violence to which the bone is subjected; the accompanying accidental bruising therewith connected is generally more dangerous than the fracture itself.

[CHELIUS overrates the violence necessary for the production of these fractures, which, excepting that of the lower angle, is rarely produced by a direct blow, and usually by a fall on the elbow, which drives the head of the arm-bone upwards. Nor have I ever seen any very serious bruising of the soft parts attending these accidents.—J. F. S.]

631. The *acromion* is most frequently broken, and generally at its base and horizontally. The outer portion is dragged down by the weight of the arm, and the shoulder inclined downwards and somewhat inwards: a depression is felt at the seat of fracture, which subsides if the arm be somewhat separated from the trunk, and raised parallel to its long axis; and when in this position the arm is moved, there is distinct crepitation (1). At the moment of the accident the patient feels a dropping down of the arm, and has but little power to raise it.

For the purpose of bringing the broken ends into proper place, and there retaining them, a conical pad should be placed between the arm and the trunk, with its thick base below the elbow, the arm pressed upwards and confined in that position with a bandage, which should be carried in shape of a figure of ∞ around both shoulders and the elbow of the injured side. The fore-arm is to be supported in a sling. Should this apparatus not serve the purpose, as for example, in women with large bosoms, the arm must be supported on a pillow with a strap, or the patient should be kept in bed, and the arm put at a right angle with the trunk.

[(1) To these signs of a broken *acromion* may be added the jutting of the fractured end of the spine of the bone, and the flattened form which the shoulder assumes instead of its natural rounded shape, by which the appearance of dislocation into the arm-pit is produced, and with which it is often confounded, but is easily distinguished from, by raising the elbow, when the roundness of the shoulder is restored and the appearance of dislocation ceases.—J. F. S.]

632. Fracture of the *neck of the Shoulder-blade* is rare, and only consequent on very great violence; it is therefore always accompanied with considerable bruising. The lower end of the fracture is so much drawn down that the shoulder has an appearance similar to that of dislocation,

The diagnosis of the fracture is grounded on the readiness with which the arm can be raised up, by its dropping down when left to itself, and by the crepitation. The apparatus is the same as in fracture of the acromion, only the pad may be withdrawn (1).

[(1) There seems to be good reason for believing that this accident never occurs. That which has been so long described under this name has been shown by ASTLEY COOPER, as will be presently stated, to be a fracture of the head of the upper-arm. I believe there is not any existing specimen of fracture of the neck of the blade-bone.—J. F. S.]

633. If the *coracoid process* be broken, which happens but rarely, the broken piece is drawn down. This displacement is removed by bringing the arm to the chest, in which position it is to be kept. In such fracture there must be always much bruising (1).

[I had an instance (*a*) of this accident, under my own care some years ago in St. Thomas's Hospital, and was accompanied with partial dislocation of the upper-arm-bone, from the glenoid cavity, and fracture of the olechranon.—J. F. S.]

634. Fracture of *the body of the Blade-bone* may be either vertical or transverse. Vertical fractures which run through the spine of the shoulder-blade are rarely accompanied with displacement, which, even when existing, is always slight. Crepitation is observed when the hand is laid flat upon the shoulder-blade. A compress dipped in some dispersing lotion is to be laid on the seat of fracture, and the arm should be kept by the already-mentioned bandage (*par.* 631) close to the trunk.

Transverse fractures rarely happen above the spine, but mostly beneath it near the lower angle, in which case the lower portion may be moved forwards or forwards and upwards.

In fractures of the *lower angle* of the shoulder-blade it is best to keep the arm close to the trunk. The cure is always effected with some deformity; but which does not interfere with the motions of the arm. If the fracture be farther from the angle, the broken ends may be brought into contact, when the arm is brought forwards against the chest, and so confined that the hand rests upon the sound shoulder. The patient, however, can rarely endure this position, and therefore we must generally be content with approximation and confinement of the arm to the trunk.

[I have never seen a vertical fracture of the blade-bone; but I have seen a fracture of the spine parallel to its length and below its ridge, though under what circumstances I do not remember.

Neither have I ever seen transverse fracture above the spine, and not many times below it, as this accident is by no means frequent. In the cases I have seen, the lower end of the bone could not be brought forwards and upwards as CHELIUS mentions, nor does it seem to me possible, on account of its nearness to the chest; but it may be raised a little backwards and upwards by thrusting the fingers between the lower angle of the bone and grasping it with them and the thumb.

The treatment of this accident is very simple, requiring nothing more than a roller tightly wound round the chest and putting the arm in a sling to keep it quiet. The French practice of putting the arm across the chest and binding the hand upon the shoulder is utterly uncalled for in this, as in most other cases in which it is advised, and must be extremely inconvenient and uncomfortable to the patient.—J. F. S.]

635. If the fracture be accompanied with crushing of the shoulder-blade, the treatment must correspond with the general treatment of compound fracture. Especial care must be taken to remove the splinters of bone by suitably large incisions, and to provide free outlet for the pus, so that it should not collect beneath the shoulder-blade, in which case even trepanning of the bone may be necessary.

(*a*) Med.-Chir. Trans. vol. xxii. p. 100.

XI.—OF FRACTURE OF THE COLLAR-BONE.

(*Fractura Claviculæ*, Lat.; *Bruch des Schlüsselbeines*, Germ.; *Fracture de la Clavicule*, Fr.)

Bradsor, in Mémoires de l'Académie de Chirurgie, vol. v.

Evers, Bemerkungen über der Nutzen der **Brasdor**'schen Binde zum Schlüs selbeinbruche; in **Richter**'s Chirurgischer Bibliothek, vol. v. p. 141.

Brünninghausen, H. J., Ueber den Bruch des Schlüsselbeines. Würzburg, 1791. With a copper-plate. Large 8vo.

Desault, Œuvres Chirurgicales, vol. i. part i. p. 63.

Wardenburg's Zusatz., p. 122.

Vermandois, Remarques sur le Traitement de la Fracture de la Clavicule; in the Journal Général de Médecine, vol. xxi. 1804.

Boyer, Traité des Maladies Chirurgicales, et des Opérations qui leur conviennent, vol. iii.

Wilhelm, Ph., Ueber den Bruch des Schlüsselbeines und über die verschiedenen Methoden, denselben zu heilen. With lithographic sketches. Würzb., 1822. 8vo.

Ribes; in Mémoires de la Société Médicale d'Emulation. Paris, vols. ix. iv.

636. *Fracture of the Collar-bone* occurs either between its sternal end and its connexion with the coracoid process, or between the latter and the scapular end. The former is the most common kind of this fracture, and is generally consequent on violence which operates on the shoulder, elbow, or hand, whilst the arm is outstretched; the latter kind is mostly produced by direct violence upon the collar-bone, in which case it is always connected with bruising of the soft parts.

637. In fracture *between the sternal end of the collar-bone and its connexion with the coracoid process*, the *diagnosis* is always easy. The patient feels pain at the seat of fracture; the motions of the arm are difficult, but little painful; the patient cannot bring his arm up to his head (though this is possible some days after when the pain has passed by); the shoulder is lower and more inwards; the arm rolls inwards; the patient supports the elbow with the other hand; distinct displacement of the broken ends is felt; the inner end rises upwards and forwards; the outer drops below it and is directed downwards. The shoulder may be easily returned to its natural height, when the displacement of the broken ends ceases, but returns when the shoulder is again left alone. Distinct crepitation is commonly observed.

In a transverse fracture, which I have frequently observed in children, there was no separation of the fractured ends. Only in the rare case of an oblique fracture from behind and beneath, forwards and upwards, is the hinder end of the fracture above the front end, and lies with its whole under surface upon the upper part of the front piece.

638. Fracture of the collar-bone is generally of no great importance, and the symptoms are dangerous only when bruising or wounding of the soft parts, or of the vessels and nerves lying beneath the collar-bone accompany it.

Setting of this fracture is easy; yet only in very rare cases is the cure possible without any deformity, but if this be not great, it does not at all restrict the motions of the arm. In considerable deformity, when the broken ends unite at an acute angle, the elevation of the arm is impossible, the *m. deltoides* wastes, the blade-bone projects strongly, and the collar-bone is materially curved. In a remaining artificial joint, the use of the limb was not destroyed, (**Gerdy**, **Velpeau**,) but imperfect.

639. To *set* the collar-bone, the upper end of the upper arm should be laid hold of on the inside, and pressed outwards, and somewhat backwards,

whilst with the other hand the elbow is brought inwards and somewhat forwards; or the knee should be placed between the shoulder-blades, and the shoulders drawn back with both hands. The apparatus for retaining the broken ends in their proper position, are (with the exception of the inappropriate bandages) the *spica Glaucii*, (Galen,) the *metraclavicularis*, the figure-of-eight bandage, (Paré, Petit,) the *spina humeri descendens*, (Kluge, L. Richter,) the cross of Heister, the bandages of Brasdor, Evers, the straps of Brünninghausen, Wilhelm, and Eberl (*a*), the apparatus of Desault and of Boyer, that of Brefeld (*b*), of Eichheimer (*c*), Koppenstædter (*d*), and Keckely (*e*). Rest upon the sound side in bed is to be recommended, in which the injured side is to be supported with a pillow and the elbow, as far as possible, laid backwards on the body (*f*), or the fore-arm and elbow put in the horizontal position, supported by means of a sling, and the arm fastened by a bandage to the body (*g*), as well also by connecting the elbows together behind the back.

Cruvelhier's apparatus (*h*) is only a modification of Desault's; the same also is that of Laserre (*i*); of Flammant (*k*); and Delpech (*l*).

Earle, H. (*m*), proposes for fracture of the collar-bone an arm-sling, for the purpose of more perfectly fixing the upper end, which is also applicable in fractures of the acromion and neck of the blade-bone. Amesbury (*n*) gives a modification of Earle's apparatus.

Richerand (*o*) puts the arm in a simple sling, so that the elbow is supported, and the arm kept against the trunk; a simple compress is put in the arm-pit to absorb the perspiration and prevent excoriation. Wattmann (*p*) puts the hand upon the uninjured shoulder, fastens it with cloths, and puts a ring beneath the point of the elbow. Mayor (*q*) puts a triangular cloth beneath the under third of the upper-arm around the chest; he then carries the depending triangular corner between the fore-arm and breast, upwards, and the one end over the injured, and the other over the sound shoulder, and fastens them behind on the breast part of the cloth.

Hubenthal's (*r*) apparatus may also be used.

Rénaud's (*s*) apparatus for simultaneous fracture of both collar-bones.

640. The apparatus which draw back the shoulders (those of Heister, Brasdor, Evers, Brünninghausen, Wilhelm, and others) have this objection: that they do not preserve the setting, easily produce excoriations of the arm-pit, swelling of the arm, and often unendurable pain, especially if the straps be broad and not roundly padded. Keeping in bed is very annoying to many patients. The apparatus of Desault and Boyer is therefore usually considered most preferable in this fracture. In the former a pillow, three and a half inches thick at the base, gradually thinning, and from five to six inches long, is applied with its base upwards, between the arm and the breast, and confined with a bandage. The elbow

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(*a*) Kritische Bemerkungen über die gegenwärtig noch üblichen Methoden der Schlüsselbeinbruch zu heilen, nebst Angabe eines verbesserten Verbandes; in Rust's Magazin, vol. xxvi. p 462.

(*b*) Neue und sichere Methode, den Bruch der Schlüsselbeines zu heilen; in Rust's Magazin, vol. xxvii. p. 555.

(*c*) In Graëfe und von Walther's Journal, vol. xiv. p. 533.

(*d*) Ibid.

(*e*) American Journal, 1836. No. 24.

(*f*) Flajani, Collezione d'Osservazione e Riflessioni di Chirurgia. 4 vols. 8vo. Roma, 1803.

(*g*) Larrey; in Dictionnaire abrégé des Sciences Médicales, vol. iv. p. 365. 1821.

(*h*) Médecine pratique éclairée par l'Anatomie et la Physiologie pathologiques, cah. i. Paris, 1821.

(*i*) Dissert. sur la Lithotomie, etc. Paris, 1814.—Froriep's Chirurg. Kupfert., pl. ccxxvii.

(*k*) Journal Compl. du Dictionn. des Sciences Médicales, vol. xxxvi.

(*l*) Gerdy, Traité des Bandages et Appareils de Pansement. 8vo. et Atlas, 4to. Paris, 1826.

(*m*) Practical Observations on Surgery. 8vo. London, 1823.

(*n*) Syllabus of Surgical Lectures on the nature and treatment of Fractures, &c. London, 1827. p. 66.

(*o*) Histoire des Progrès récens de la Chirurgie. Paris, 1825. p. 132.

(*p*) Med. Jahrbücher des k. k. öststaates, vol. vi. p. 2.

(*q*) Gazette Médicale, 1835, No. 15.

(*r*) Rust's Magazin, vol. xlix. part 1

(*s*) Bulletin des Sciences Médicales, 1811, Nov.

is to be brought forwards upwards and inwards, and retained by a bandage in that position. A moistened compress is to be laid on both sides of the broken collar-bone, and upon the fracture a pasteboard splint, fastened with a bandage, and carried into the sound arm-pit, over the breast, the injured shoulder, upon the back of the arm to the elbow, and thence again to the sound arm-pit, over the back, the injured shoulder and front of the arm beneath the elbow, over the back to the sound arm-pit, and when these turns have been repeated, the bandage is to be expended in circular turns around the trunk. The fore-arm is to be supported in a sling. The apparatus of BOYER effects the same as DESAULT's, but is preferable for its simplicity, its easier application, and that it does not compress the chest so much. The pad is held up by two bands which are tied upon the sound shoulder, and the arm fastened in a proper position by a body-girdle. But even both these apparatus have great deficiencies. If they be applied so tightly that the broken ends are kept in close contact, they cannot be endured, on account of the constriction of the chest; in women with full bosom, they cannot be applied at all. They also yield easily, must be very often re-applied, and commonly there remains, long after the cure, a decided stiffness of the whole limb. Therefore many Surgeons (DUPUYTREN, CLOQUET, SALAMON, JÆGER) employ a cushion only with bands, put the arm in a sling, and fasten it to the chest with a circular bandage partially around the fore-arm, and some turns over the injured shoulder. It is considered also that the close union of the fracture of the collar-bone depends less on the apparatus, than on the position and direction of the fracture (therefore in spite of the most careful application of this apparatus, some deformity often remains); and, finally, that in children, on account of the yielding of the ribs, these apparatus have not any steadiness. The proper support of the arm must therefore be effected by a sling, or by an arm-tray, by which the arm is at once kept properly to the body, as the most simple and fitting treatment, and so much the more, as it is unaccompanied with inconvenience, and the cure is as good as with many other apparatus. After numerous experiments, I prefer BREFELD's apparatus before all others, (in which both shoulders are brought together towards a board provided with a thick covering, placed upon the back, and to which they can be drawn back by padded straps,) on account of its simplicity, its easier application, and the little inconvenience it causes. Whether by the pasteboard apparatus, in any way applied, (MEYER,) any advantage could be gained, is matter of great doubt, after the preceding review of the various apparatus.

[With CHELIUS's general observations on the treatment of fractured collar-bone I fully agree, but I prefer merely bending the arm close to the side, with a thick pad in the arm-pit to keep the shoulder out and prevent the broken ends of the bone riding over each other; the elbow should also be supported and brought a little forward by a short sling tied upon the sound shoulder. This sling helps to keep up the outer end of the fracture in its proper place.

I do not like any of the apparatus in which the shoulders are drawn back by bandages, as these invariably annoy the patient, often cause excoriation, and are never kept long in place, the person continually wriggling them off to relieve himself of the pressure.—J. F. S.]

641. At first the apparatus never should be tightly applied, but subsequently it may be made tighter. For the first days after its application the patient should be kept quiet, but afterwards he may go about. It is however to be observed, that a sitting posture, in which the patient can

lie only on the sound side, and leave the other quite free, best prevents the displacement of the apparatus and the broken ends of the bone, and therefore the patient should sleep in that posture. In five or six weeks the fracture is consolidated. The accompanying symptoms must be treated after the general rules.

642. In *Fracture of the Collar-bone between the coracoid process and the scapular end* there is scarcely any displacement, and therefore the *diagnosis* is often very difficult. The *treatment* consists in fastening the arm to the trunk upon a moderate sized pillow, and getting rid of the bruises.

XII.—OF FRACTURE OF THE UPPER-ARM.

(*Fractura Humeri*, Lat.; *Bruch des Oberarmbeines*, Germ.; *Fracture de l'Humerus*, Fr.)

643. *Fracture of the Upper-Arm* is distinguished into that of the *neck* and of the *body*.

644. The *Fracture of the Neck of the Upper-Arm-bone* (*Fractura colli humeri*) is that which takes place either near the tubercles of the bone, in them, or above them, at the properly so-called *collum humeri*. In the *first* case, the upper part of the fracture is drawn outwards and upwards by the *m. supra- et infra- spinatus*, whilst the *m. latissimus dorsi, pectoralis major* and *teres major*, draw the lower end inwards: in the *second* case, there is not any displacement, because the seat of fracture is equally surrounded with muscles; and in the *third* case, the lower end is displaced inwards.

645. The *diagnosis* of this fracture is often very difficult, especially if much swelling have taken place. The patient feels, at the moment of the injury, severe pain, often hears a crack, and cannot move his arm. A hollow is noticed beneath the *acromion*, but the shoulder has still its natural form. The limb may be moved in all directions, although with pain. If one hand be put on the shoulder, and the lower end of the arm-bone be pulled with the other, rotation being made at the same time, crepitation is often felt, and diminished motion of the head of the bone. If the lower end of the bone be inclined inwards, a projection, not rounded, is felt in the arm-pit.

This fracture is for the most part consequent on severe violence, which acts immediately on the shoulder; it is therefore commonly accompanied with severe bruising and much inflammation. It more rarely happens by a fall upon the elbow or hand, when the arm is apart from the body; and is most common in children and old persons, but rare in mid-age.

[Fracture of the greater tubercle of the upper-arm-bone sometimes happens, of which there is an example in St. Thomas's Museum; the process appears as if sliced off from the shaft of the bone, and remains attached to the tendons of the outward rotating muscles.

Astley Cooper describes (*a*) a fracture "at the junction of the head of the *os humeri* with the tubercles at the part at which the capsular ligament is fixed, and where, in young people, the epiphysis is placed. In them it is a very frequent occurrence; it sometimes, though more rarely, happens in the old; in middle age it seldom occurs;" and he gives the following signs:—"The head of the bone remains in the glenoid cavity of the *scapula*, so that the shoulder is not sunken as in dislocation. A projection of bone is perceived on the coracoid process, and when the elbow is raised and brought forwards, this projection is rendered particularly conspicuous. By drawing down the

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(*a*) On Dislocations of the Os humeri, &c., and upon Fractures near the Shoulder-joint; in Guy's Hospital Reports, vol. iv. 1839.

arm, the projection is removed, but it immediately reappears upon giving up the extension, and the natural contour is lost." (pp. 277, 78.)

I am quite sure that I have twice seen this accident in boys of about twelve years old, which, on the whole, corresponded with the appearance of fig. 1, pl. iii., in COOPER's Paper. In neither of my cases was there the projection at the coracoid process which he mentions, and which I imagine was caused only subsequently by the ossific matter thrown out during the cure, as seen in the figure. In both my cases, the fracture seem to be very oblique from without and above downwards and inwards; the head of the bone remained in the socket; but the great tubercle formed a blunt elevation nearly as high as the top of the *acromion*, and in one of the cases could not be brought down to its proper place, but united, forming a projection through the outer and upper part of the deltoid muscle.

I have already mentioned, that the accident commonly heretofore spoken of as fracture of the neck of the *scapula*, and to which the characters described have been assigned, has been ascertained not to be a fracture of that bone, but of the upper-arm-bone. It was first determined by ASTLEY COOPER, who calls it a fracture "in the surgical neck, (of the upper-arm-bone,) viz., between the tubercles and the insertion of the *pectoralis major*, *coraco-brachialis*, *latissimus dorsi*, *teres major*, and the *deltoides* muscles." (p. 281.) He has not, however, given any description of it, but, as would appear from the engravings, (pl. vi.) the broken inner part had slipped down and become attached to the inside of the shaft of the bone, so that the head facing directly inwards instead of upwards, has its upper part rather below the top of the great tubercle. The patient was a man of seventy-one years of age, and having lived two years after the accident, the union was complete.

I have also a case of this kind, in which the patient, about sixty years of age at the time of the accident, died twenty years after. His symptoms were precisely those described as fractured neck of the blade-bone. The fracture has extended obliquely downwards and backwards between the front of the great tubercle and the outer edge of the bicipital groove for about three inches downwards and inwards, taking off the head and greater tubercle, which have together slipped down, back, and a little outwards, so that the broken front edge of the neck seems thrust into the shaft on the inside of the little tubercle, although really only lying tilted a little into it. The head of the bone, in consequence, faces directly inwards, instead of as naturally, inwards and upwards, and its top is about the eighth of an inch below the top of the tubercle. The oblique or broken piece of the shaft is seen resting upon the back of the shaft itself, the wall of which is thinned. It seems to me that there is not much difference between COOPER's case, just mentioned, and this, and that which he describes as very frequent in children.—J. F. S.]

646. The *setting* of this fracture is effected by an assistant, with both his hands fixing the patient's shoulder, whilst another holds the fore-arm, with one hand above the wrist-joint, and presses with the other on the fore-arm. The arm is now to be swathed in a moist roller, a few turns made round the sound shoulder, and the bandage given to an assistant to hold. A narrow splint is then to be applied, from the bend of the elbow to the *acromion*; a second from the outer condyle to the same height; a third from the *olechranon* to the edge of the arm-pit; and a fourth from the inner condyle to the arm-pit, and these are to be fastened with some descending turns of the bandage. A pad is to be placed between the arm and the chest, as in fractured collar-bone, with the thick end upwards, upon which the arm is to be fixed with the spiral bandage, which should be carried round the chest; some turns of the bandage are to be taken beneath the elbow over the sound shoulder, for the purpose of supporting the arm, and the fore-arm must be put in a sling. This apparatus must be often renewed, because it very easily becomes displaced; it presses much on the chest, and in women with full bosom cannot be employed. For these reasons, and because we can scarcely act upon the upper end of the fracture, RICHERAND (*a*) thinks it best to place the injured arm against the body, and so to bend the fore-arm that the hand may lie upon

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(*a*) Above cited, p. 143.

the shoulder of the sound side; the arm is then to be kept in this position by circular turns, which are to act especially on the elbow. By this position the lower end of the fracture is approached to the upper, and the side of the chest serves as a splint. The symptoms of bruising and inflammation, must be properly attended to.

[There is not the least necessity for the constrained position which Richerand recommends: the method directed by Chelius is most convenient, most agreeable to the patient, and serves every purpose.—J. F. S.]

647. *Fracture of the body of the Arm-bone* is distinguished as occurring *above the insertion of the m. deltoides*, *in the middle of the arm*, or *at its lower end*. In the *first* case, the upper end of the fracture always inclines inwards, and the lower outwards; in the *second*, the upper end inclines outwards, and the lower inwards, and if the fracture be oblique, also upwards; in the *third* instance, if the fracture occur where the bone is surrounded by the *m. triceps* and *brachialis*, without these muscles being attached to it, displacement may happen in every direction; but in fracture near the joint, it can be only forwards or backwards. The *diagnosis* of the fracture is generally easy. Fracture at the lower end of the arm-bone is alone liable to be mistaken for dislocation of the elbow. The *olechranon* is drawn upwards and backwards by the action of the *m. triceps*, is raised from half an inch to an inch and a half, and above it is a hollow; the upper end of the fracture projects forwards, forms a large uneven projection, the diameter of the arm near the elbow is much increased from before to behind; the fore-arm is slightly bent, its perfect bending or straightening is impossible, and every attempt thereto very painful. The Surgeon has however a guide in that, by extension the deformity, as in dislocation, readily subsides, but recurs when the extension is left off; by moving the ends of the fracture, crepitation is felt, (which, however, is often wanting,) and especially, that by pressure with the fingers replacement is possible; and the distance of the *olechranon* from the condyles of the arm-bone, which is natural in dislocation, is here as great again (*a*). This fracture is much more frequent in children than in adults.

648. In general, fracture of the upper-arm is not an important injury. But an unnatural joint remains after its fracture in the middle, more frequently than in all other fractures, and when at the lower end of the bone there is commonly stiffness at the elbow-joint.

649. The *setting* is to be performed in the same way as in fracture of the neck (*par.* 646.) Slight extension is sufficient to put the fracture into place. The fore-arm being then bent at an obtuse angle, both it and the upper-arm are to be swathed in a moistened roller, which is to make three successive turns on the seat of fracture; four narrow splints are then to be applied on the upper-arm, which are to be fixed with the descending turns of the same bandage. The fore-arm is then to be supported in a sling, over which some circular turns are to be made around the arm and chest, for the purpose of fixing the former as firmly as possible. If one or other end of the fracture be disposed to turn outwards or inwards, a pad, of which the thicker end is to be directed upwards or downwards, may be put between the arm and the trunk.

The fracture at the lower end of the upper-arm is to be treated in the same way, the arm put in a bent position, both it and the upper-arm swathed with a circular bandage, and two pasteboard splints, notched at their

(*a*) Dupuytren, Leçons Orales, vol. iii. p. 394.

middle on both sides, applied on the whole length of both upper- and fore-arm, and upon the sides of flexion and extension, and fastened with another bandage. The fore-arm should also be put in a sling. The apparatus must be re-applied as often as it gets displaced, and the patient treated according to the inflammatory symptoms. In forty days the consolidation is usually effected.

In all fractures of the upper extremities in which swathing with a circular bandage is used, it is always best to enrol each finger in a small bandage, and to commence the application of the larger one at the wrist; by which we prevent the turns above the hand being so readily loosened and stripped off.

In the permanent apparatus of Seutin, the five fingers should first be swathed, and afterwards the hand and fore-arm surrounded with a circular bandage, to be applied during the extension and counter extension also over the fore-arm. The bandages may be overspread with plaster of Paris, and the fore-arm kept half bent, between pronation and supination. A pair of pasteboard splints, an external and an internal one, should be cut out to fit, which, as they are applied throughout the whole length of the limb, should correspond to the angle at the elbow-joint, so as to exactly fit the bend of the fore-arm. They should be only so broad, that when applied there may be a finger's breadth between them before and behind, so that they may be capable of being brought nearer together. The splints, moistened and spread with plaster, may be applied, fastened with a new bandage, with which, if you please, a ∞ bandage may be formed beneath the opposite arm-pit, and a spica on the injured shoulder. The bandages are to be smeared with the plaster. If it be necessary to perform the motions of flexion and extension at the elbow-joint, the splint must be either divided into two parts at the elbow-joint, or it must be torn at the proper part, after it has been moistened with water, and the elbow-joint surrounded with a fresh bandage, covered with a thin layer of plaster, by which the part may attain its suitable firmness. In fracture of the lower part of the upper arm, I have always found the above-described apparatus sufficient.

Dupuytren laid the arm on a pillow, applied on the front and back of the seat of fracture circularly two graduated compresses, three or four inches long and two inches broad, fastened with two long pads and Scultetus's bandage, and then applied below two chaff bags, and splints on the front and back, and fastened them with bandages.

If this fracture be not set it forms a misshapen callus, and the upper end continuing to project, the bending and straightening of the upper arm is considerably interfered with.

[Fracture through the middle of the upper-arm may be very well treated with a gum roller.

Fracture of the lower third of the bone is best managed with Amesbury's angular splint placed in front of the bend of the elbow.—J. F. S.]

650. A bad complication of the fracture at the lower end of the upper-arm-bone is the separation of the condyles. They are either both separated by a vertical cleft which extends to the transverse fracture, or one or other condyle is separated by an oblique fracture. In the *first* case the deformity of the joint is distinct, the fore arm is generally in a state of pronation, and the mobility of both condyles and crepitation are perceptible; in the *second*, mobility and crepitation of one condyle only is felt. In fracture of the outer condyle the crepitation is felt, especially in rotation of the hand and spoke-bone; if the fractured piece be large it is drawn backwards, and the spoke-bone with it. In fracture of the inner condyle, the cubit is drawn back and its point of support lost; if the fore-arm be straightened the hand is drawn inwards, but this disappears on bending the fore-arm. In these cases there is always considerable swelling, which renders the *diagnosis* very difficult. If the fracture be set and the condyle put in its proper place, the apparatus must be applied as already described, and displacement prevented by four splints, which must be arranged to prevent bending of the elbow-joint. The inflammation is always very considerable, and after cure the motions of the joint are much interfered with

or completely destroyed. According to Astley Cooper these fractures unite merely by ligamentous inter-substance except when the fracture is external to the capsular ligament.

[The splitting of the lower end of the upper-arm-bone into the joint is certainly the worst kind of fracture of this bone; but the higher it splits up, of the less consequence is it, as there is then ample room for its bony union external to the capsule.

Fracture of the condyles, especially of the inner, is a very common accident in children, and, if not seen immediately after its occurrence, is difficult, to distinguish on account of the very great effusion which speedily occurs. If it cannot, therefore, be easily discovered, it is best to apply an evaporating lotion for a few days, and then examine it. No bandage should be put on till the swelling has subsided, for at first it cannot be worn on account of the pain from the pressure, and afterwards if applied whilst the swelling is subsiding, it is continually loosening and needing repeated reapplications. The best mode of treating it is, to bend the fore-arm whilst supine, which relaxes all the muscles attached to the condyle; and then having applied a piece of wetted pasteboard, notched on each side at the bend of the joint, both before and behind the upper- and fore-arm, to wind a roller around it. A very important part of the treatment consists in employing gentle passive flexion and extension of the fore-arm about a fortnight after the accident, and gradually increasing it from day to day, otherwise the ligamentous matter thrown out often restricts the movements of the joint.

Fracture of the outer condyle is less frequent but is to be treated in the same manner. —J. F. S.]

651. In Compound Fractures of the upper-arm the limb is to be placed in a slightly bent position upon a pillow, the arm bandaged to suit the wound with Scultetus's bandage, and the splints fastened with a double bandage. The rest of the treatment is to be according to the ordinary rules. Sauter has proposed his suspensory apparatus for compound fractures of the upper-arm.

[In treating compound fracture of the upper-arm care should be taken that the splints, if applied immediately, should not be bound tightly. I think it is best, merely to bandage the arm to a single well-padded splint, upon which it may lie till the wound be healed, or at any rate till all inflammation has subsided. If the wound be considerable and the patient restless, it is advisable to put on, as a second, Abernethy's bracket-splint, by which the ends of the bone are kept quite quiet, and the wound can be daily tended without disturbing the apparatus. When the wound is perfectly healed, the case is to be treated merely as a simple fracture.—J. F. S.]

XIII.—OF FRACTURE OF THE BONES OF THE FORE-ARM.

652. Of these are distinguished *fractures of the spoke-bone alone* or *of the cubit alone*, *fracture of both bones together*, and *fracture of the olechranon.*

653. *Fracture of the Spoke-bone alone* (*Fractura Radii*, Lat.; *Bruch der Speiche*, Germ.; *Fracture du Radius*, Fr.) is more frequent than that of the cubit and mostly consequent to a fall on the hand, when the arm is outstretched, in which case it usually happens in the middle of the bone; more rarely it is produced by direct violence. The *diagnosis* is not difficult; the seat of fracture is felt, and during pronation and supination, crepitation also. The fractured ends turn towards the cubit. Only when the fracture is near the lower end of the bone is the diagnosis difficult, and its confounding with sprain so much the more possible, as frequently at the first there is scarcely any or no distortion of the hand, nor is its motion interfered with. The following appearances arise from the displacement of the fractured ends: the hand is more perfectly prone than if it were dislocated to the dorsal or radial side; the lower end of the fore-arm is narrower, less flat, more rounded; there is a bending inwards of

the fore-arm, half an inch or an inch above the wrist on the radial side, which extends to the dorsal surface of the spoke-bone; the head of the cubit makes a considerable projection and the wrist-bones are more inclined to the ulnar side; the *carpus* seems to project somewhat on the dorsal surface of the spoke-bone, and, therefore, the back of the joint is generally rather swollen. On the palmar surface of the fore-arm, corresponding to the concavity of the spoke-bone, there is a very full, elastic swelling, often accompanied with extraordinary tension of the flexor tendons. In consequence of the depression on the edge of the spoke-bone and the projection of the head of the cubit, the whole radial side projects more at the *carpus* and thumb, *i. e.* the hand is inclined to the radial side and its length inclines much outwards from the fore-arm. The hand is movable at the joint and both styloid processes are in natural relation to the *carpus.* The patient has less pain at the joint, than at the lower end of the spoke-bone, at the depression on the radial side, and in the swelling on the palmar side, on the head of the cubit, and in the capsular ligaments, beneath it; the pain is increased by pressure. On both surfaces of the lower end of the spoke-bone may be easily felt the irregularities arising from displacement of the fractured ends, and which consist in a transverse, often oblique projection of the upper end of the fracture, three or four lines above the wrist-joint, and in a less distinct projection of the upper part of the lower fractured portion on the dorsal side, eight or ten lines above the joint. Frequently, if the fracture be somewhat higher, both ends may form an obtuse angle towards the palmar surface, in which case the depression on the dorsal surface is greater. Motion and crepitation are not always felt. JÆGER found the upper fractured end firmly resting on the cubit. Pronation and supination, bending and violent straightening of the hand, are very painful and restricted. In pronation, the rotation of the head of the spoke-bone is wanting, the fingers are usually half bent; the deformity is generally diminished by extension, but soon returns. The inflammatory swelling often spreads considerably. If the fracture be not, or if it be only imperfectly set and improperly treated, the deformity and incapability of perfectly bending the hand remain. This fracture is distinguished from dislocation by the natural position of the styloid process which has not lost its connexion with the *carpus,* which is movable and has its long axis separated only a little from the spoke-bone (JÆGER (*a*).) The upper end of the fracture is somewhat displaced towards the side of extension or flexion; but the fingers can be moved freely, and when the hand bends the joint ends of the spoke-bone follow the movement of the wrist-bones, by which this fracture is distinguished from dislocation (*b*).

The fracture of the lower end of the spoke-bone is extremely well explained by the observations of DUPUYTREN (*c*), and the opinion put forward by him and by BRODIE, that it is mostly confounded with sprains and dislocations is confirmed by the more recent observations of Surgeons.

[Fracture through the neck of the spoke-bone is not an uncommon accident, and very liable to be confused with dislocation of the bone forwards on the outer condyle of the upper-arm. It is accompanied with much distortion and swelling, and being naturally deeply embedded in the muscles, is difficult to make out satisfactorily. The head of the bone must be grasped with the thumb and finger of one hand, whilst the other draws the lower end of the bone from it by pulling at the hand alone, and then upon rotation if there be fracture the crepitation will be felt.

(*a*) Above cited, vol. iii. p. 275.

(*b*) GOYRAND, Mémoire sur la Fracture de l'extrémité inférieure du Radius. Paris, 1836; and in Journal Hebdom., 1836, Feb.

(*c*) Above cited, vol. iv. p. 161.

The principal cause of the altered shape of the fore-arm when the spoke-bone is broken near its base, is the constant dragging towards the cubit which is made on it by the *m. pronator quadratus.*—J. F. S.]

654. *Fracture of the Cubit* (*Fractura Ulnæ*, Lat.; *Bruch der Ellenbogenröhre*, Germ; *Fracture du Cubitus*, Fr.) is always consequent to direct violence acting on it. The lower fractured end inclines inwards towards the spoke-bone, the upper remains undisplaced on account of its former connexions at the joint. The irregularity is felt at the seat of the fracture, also mobility of the lower fractured end, and crepitation in pronation and supination.

655. *Fracture of both bones of the Fore-arm* occurs most commonly in the middle, frequently at the lower end, but rarely at the upper end. Both bones are often broken at the same, and often at different places. In most instances this fracture is produced by violence which affects the fore-arm, and more rarely by that which acts on the outstretched hand. The deformity arising from diminished breadth of the fore-arm, in which the broken ends are inclined inwards; the unnatural mobility at one part, where a distinct pressing inwards of the bones is perceived; the impossibility, on the patient's part, of bringing the arm into pronation and supination; the distinct crepitation when the Surgeon performs this motion, in which it is also observable that the upper end of the fracture does not follow these motions, are the symptoms which characterize this accident beyond all doubt. Only in fracture near the wrist the symptoms mentioned (*par.* 653) must be borne in mind to avoid confounding it with dislocation. In fracture of the upper part of the fore-arm there is scarcely any displacement of the broken ends.

656. The fractures of the fore-arm are generally unimportant accidents. The only thing, however, to be dreaded is, that when the broken ends unite out of place, pronation and supination will be interfered with or rendered quite impossible after the cure.

657. *Setting* of the simultaneous fracture of both bones is effected by extension of the hand and counter-extension of the fore-arm when half bent, and between pronation and supination. The Surgeon then presses the soft parts on both sides of the fore-arm with his fingers into the interosseous space, for the purpose of bringing the broken ends into proper place. Two long graduated compresses are then to be put on both sides of the fore-arm which are to be fastened with a circular bandage applied from the tips of the fingers; upon these are to be put two splints reaching from the elbow to the wrist and fastened with a second bandage. The fore-arm is then brought forwards to the breast and supported with a sling, or in an arm-tray. The bandage is not to be applied too tightly at first, because usually much swelling arises; it is to be renewed, if not becoming loose previously, on the tenth or twelfth, then on the thirtieth or fortieth day when the fracture is consolidated.

Fracture of the *spoke-bone* or of the *cubit* alone, requires, in setting, only the bending of the hand, in the opposite direction to the fracture, then the pressing in of the soft parts between the bones and the apparatus already described. In fracture of the spoke-bone or cubit alone near the wrist it may be often necessary, according to Dupuytren, besides the apparatus just mentioned, to place on the under part of the unbroken bone a thick pad and an iron splint somewhat bent below, which is longer than the fore-arm, and by means of some circular turns to draw the hand to the contrary side.

In order to keep the hand in the direction towards the ulnar side, recommended by **Dupuytren**, in fracture of the lower end of the spoke-bone, **Blandin** employs two splints, which are bent with a knee opposite the wrist, for the purpose of drawing the hand to the ulnar side with the last turns of the bandage. **Goyrand's** apparatus (*a*).

[If the spoke-bone alone be broken, the splints, which should extend beyond the tips of the fingers, should be bandaged only to the wrist, and the fore-arm put in a sling which should not extend further, and placed horizontally in a position intermediate to pronation and supination with the thumb upwards. Thus arranged the weight of the hand drags continually on the base of the spoke-bone, and tiring the muscles connecting this side of the hand and arm, the weight of the hand pulls the lower end of the fracture and retains it in place.

Fracture of the cubit requires the bandage to the end of the fingers so as to keep it in place by the drawing down of its lower end, to which the spoke-bone serves as a stret.

In fracture of both bones the fore-arm is best laid supine.

In all fractures of the fore-arm the splints should either have convex surfaces towards the limb or should be well padded along their middle, so as to thrust the muscles between the bones and keep them well apart.—J. F. S.]

658. If the fracture of the fore-arm be complicated with wound, it must be laid on a pillow, surrounded with **Scultetus's** bandage, and the treatment conducted after the general rules.

659. *Fracture of the Olechranon* is most commonly transverse, rarely more or less oblique, and may be caused by direct violence upon the *olechranon* when the arm is half bent, or by contraction of the muscles, which however is more rare. The *olechranon* rises half an inch, or two inches higher; and according as the fibrous covering is more or less torn, a space is felt between the upper and lower end, which increases if the arm be bent; the patient cannot straighten his arm; the upper part of the *olechranon* may be moved laterally; no crepitation however is discoverable, except when the distance between the two fractured ends is but very trifling. At first there is considerable swelling of the elbow-joint, and ecchymosis to a great extent.

660. The fractured ends are generally united by fibrous intersubstance, which, however, does not interfere with the motions, if they be not too wide apart; in this manner such fractures unite when left to themselves. If the fibrous covering of the *olechranon* be torn, the broken ends are farther apart, and generally unite with deformity, by which the motions of the arm are very much disturbed. If the fracture be accompanied with much bruising of the joint, and splinterings of the *olechranon*, dangerous symptoms may occur, and be followed by stiffness.

661. Although in this fracture it seems most suitable to keep the fore-arm in complete extension, and by pressure to bring the upper end in contact with the lower end of the fracture, as effected by the apparatus of **Böttcher**, **Wardenburg**, **Astley Cooper**, and **Amesbury**, yet experience proves that, in this position of the arm, an irregular and misshapen union of the broken ends may very easily be produced by *too great extension* of the arm, besides that the position itself is extremely painful to the patient. A *moderately bent position* (as when the arm hangs down at rest, or at an angle of 160°) is therefore preferable, which permits the closest contact of the fractured ends, and is least painful to the patient, as was recommended by **Duvernay** and **Sheldon**, and more especially

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(*a*) **Froriep's** Chirurgische Kupfertafeln, pl. 343, fig. 1 to 11.

by **Desault**, **Feiler**, and **Earle**. The arm is to be put into a state of slight flexion, and the hand and fore-arm swathed with an ascending spiral bandage up to the elbow. An assistant then holds the bandage, the upper is to be pressed down to the lower end of the fracture, taking care that the skin do not fold over the seat of fracture, and a sufficiently thick compress is to be put on the upper fractured piece, the ends of which should pass round to the bend of the elbow. The compress is to be fixed with a ∞ bandage, and then the bandage carried up spirally to the upper part of the upper arm, for the purpose of rendering, by sufficient pressure, the *m. triceps extensor cubiti* actionless. The fore-arm is to be supported in a sling. The bandage must be renewed as often as it becomes loose, and at the twenty-fifth or thirtieth day may be removed entirely, when we must endeavour to get rid of the stiffness of the joint by motion and volatile frictions. If much inflammation and swelling have already set in, they must be first removed by suitable treatment before the application of the apparatus. If the fracture be compound, very severe symptoms commonly arise, which are to be treated after the general rules.

Feiler has added to this apparatus a cap made of leather, and a glove connected by straps to the cap, which is put upon the *olechranon*, so that the arm is kept in a proper degree of flexion, and the upper sufficiently close to the lower fractured portion. **Earle**, after having prevented the lateral motion of the upper fractured end with a light compress and strips of sticking plaster laid obliquely over the elbow, and having brought the broken ends close together, applied a splint of stiff pasteboard, softened in warm water, upon the front and back of the arm, and fastens it with a circular bandage. The pasteboard remains on the arm till dry, during which time the patient lies on his back, with the arm on a pillow. The dry pasteboard is then to be taken off, and padded with buckskin. These splints should be sufficiently strong to prevent every motion of the joint.

[Notwithstanding all the inconveniences described by **Chelius** as connected with the straight position in the treatment of fractured *olechranon*, I must still advise its employment. I have used it very frequently, and never with the least inconvenience to or complaint of the patients.—J. F. S.]

On Fracture of the Olechranon, compare—

Sheldon, Essay on Fracture of the Patella and Olechranon. London, 1789.

Camper, P., Dissert. de Fracturâ Patellæ et Olechrani. fig. illust. Hag. Com. 1790. 4to.

Böttcher, J. K., Auswahl des Chirurgischen Verbandes. Berlin, 1795. 8vo. p. 198.

Desault, Œuvres Chirurgicales, vol. i. p. 163.

Wardenburg's Züsatze zu **Desault**'s Bemerkungen über den Bruch des Olekranums.

Feiler J., über den Bruch des Olekranums. Sulzbach, 1811. 8vo.

Cooper Astley, above cited, p. 485, Pl. xxix.

Earle, above cited, p. 143

Alcock, Practical Observations on the Patella and Olechranon. London, 1823.

Amesbury; in London Medical Repository, June, 1825.

662. Analogous to fracture of the *olechranon* may be considered the *fracture of the coronoid process of the cubit.* This fracture is extremely rare, and was first described by A. **Cooper** (*a*). It occurred through a

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(*a*) Above cited, p. 483.

fall on the hand, and on getting up, the elbow could be neither bent, nor perfectly extended, the cubit projected considerably backwards, the joint had its natural form, and the arm was bent. Although an apparatus of splints was applied for many months, yet the same appearances continued. **Brassand** and **Kuhnholtz** (*a*) have noticed between the cubit and the pulley of the upper arm bone, a hard somewhat movable body, against which the cubit struck in bending. In reference to the *treatment* of such case, **Cooper** is doubtful whether it will have a satisfactory result; for he supposes that the broken coronoid process unites only by ligamentous substance. **Cooper** found, in a corpse, an example of broken coronoid process united by ligament, and freely moving on the cubit; the sigmoid cavity was also so changed, that in straightening of the arm backwards, it is pulled over the condyle of the upper arm-bone.

Jæger (*b*) saw an imperfect fracture of the coronoid process, a deep fissure in its articular surface with considerable effusion of blood into the joints.

XIV.—OF FRACTURES OF THE BONES OF THE HAND.

663. The *Bones of the Wrist* (*Fractura Carpi*, Lat.; *Bruch der Knochen der Handwurzel*, Germ.; *Fracture du Carpe*, Fr.) can only be broken by great violence, acting directly upon them, and the fracture is always accompanied with crushing and wounding of the soft parts, by which great inflammation, mortification, nervous symptoms, or destructive suppuration may be produced. These cases require the general treatment of compound fractures, and amputation, immediate or subsequent, may be necessary.

664. *Fracture of the Mid-hand bones* (*Fractura Metacarpi*, Lat.; *Bruch der Mittelhandknochen*, Ger.; *Fracture du Métacarpe*, Fr.) is also, for the most part, accompanied with crushing and bruising; the fifth bone is most frequently broken. Slight irregularity and crepitation is always readily observed. When the broken ends have been pressed into their place, a compress and a pasteboard splint is to be laid on the back of the hand, along the broken bone, and the whole hand put, with the palm downwards, on a flat piece of wood, and there fastened with a circular bandage, passing from the tips of the fingers to the wrist.

665. In *Fracture of the Finger-bones*, after setting, the finger is to be rolled with a narrow bandage, and fastened to a small splint, or the hand laid on a flat board, to which it should be fastened with a circular bandage. If these fractures be accompanied with so much crushing that there seems no possibility of preserving the parts, amputation should be at once performed.

XV.—OF FRACTURE OF THE THIGH-BONE.

(*Fractura Femoris*, Lat.; *Bruch des Schenkelbeines*, Germ.; *Fracture du Fémur*, Fr.)

666. *Fracture of the Thigh-bone*, is distinguished as A. *Fracture of the Neck*, and B. *Fracture of the Body;* and in the latter it may occur in the upper middle or lower third.

A.—OF FRACTURE OF THE NECK OF THE THIGH-BONE.

Sabatier, Sur la Fracture du Col du Fémur; en Mém. de l'Acad. de Chirurg., vol. iv.

(*a*) von **Froriep's** Notitzen, vol. xiv. p. 311.

(*b*) Above cited, p. 482.

Ludwig, Progr. de collo femoris ejusque fracturâ. Leips., 1755.

Brünninghausen, H. J., über den Bruch des Schenkelbeinhalses. With copper plates. Würzburg, 1789. 8vo.

van Gesscher, D., über Entstellungen des Ruchgräthes und Schenkelbeines. Translated from the Dutch. Götting., 1794. p. 117.

Desault, Œuvres Chirurgicales, vol. i. p. 221.

Hagedorn, Abhandlung über den Bruch des Schenkelbeinhalses, nebst einer neuen Methode, den selbenleicht und sicher zu heilen. Leipzig, 1808.

Boyer, above cited, vol. iii. p. 231.

Delpech, Précis élémentaire des Maladies réputées Chirurgicales, vol. i p. 274.

Rhen, J. G., Dissert. de fracturâ colli ossis femoris. Hallæ, 1814.

Cooper, Astley; in his and **Travers's** Surgical Essays, and in his work, On Dislocations and Fractures of the Joints. London, 4to. and the Appendix.

Bell, Chas., Observations on Injuries of the Spine and of the Thigh-bone, London, 1824, p. 35.

Earle, Henry, Practical Observations in Surgery. London, 1823. 8vo.

Amesbury, Jos., Observations on the Nature and Treatment of Fractures of the upper part of the Thigh-bone, etc. London, 1830.

Dupuytren, Des Fractures du Col du Fémur; in his Leçons Orales de Clinique Chirurgicale, vol. ii. p. 81.

667. *Fracture of the Neck of the Thigh-bone* (*Fractura colli femoris*) may be either *within* or *without* the capsular ligament; it may be *partially within or without* the capsular ligament; it may be *double, and accompanied with separation of the trochanter*. The direction of the fracture *within* the capsule, is mostly transverse, and the fibrous covering of the neck of the thigh-bone is more or less torn; but *without*, the fracture is in general oblique. The broken surfaces are mostly uneven, and support themselves by their toothed shape; the upper may be locked into the lower end of the fracture.

668. The most frequent cause of the fracture is violence acting on the great *trochanter;* also a fall upon the outstretched foot, or upon the knee. Often also from very slight causes, for instance a false step, in which the foot slips, especially when in advanced age the neck of the thigh-bone is brittle and fragile (*par.* 575). This fracture happens most frequently in advanced age, and more commonly in women than in men. The variation in the direction of the neck of the thigh-bone at different periods of life, the greater length of the neck, and the greater projection of the great *trochanter* in females, as well as the brittleness of the bone in advanced age, renders this intelligible.

669. The general signs of this fracture are, a previous fall on the great *trochanter*, the foot, or knee; fixed pain in the hip-joint; sudden incapability of walking or standing, or at least great difficulty in so doing; shortening of the limb immediately or some time after the fracture; approach of the great *trochanter* to the spine of the hip-bone and less projection; restoration of the natural length of the limb by moderate extension, so long as the contraction of the muscles has not from its continuance become great; then at least considerable force must be employed; ready recurrence of the shortening when the extension is given up; incapability of the patient to raise the limb straight up when he lies in the horizontal posture; in almost all cases turning of the thigh and front of the foot outwards, and facility in returning it to its natural position, and even

inwards; in very rare cases turning of the foot inwards, where often at first there had been turning outwards, if, after suitable extension, the limb have acquired its proper posture; slightly bent posture of the limb, so that it lies on the outside, and the heel of the ailing foot rests behind the inner ankle of the sound one; crepitation of the broken ends on rotation of the thigh whilst it is held with one hand at the knee and drawn down, and the other hand laid upon the *trochanter*, and the knee being somewhat raised, it is observed that the great *trochanter* describes a smaller circle than usual.

670. According to the various direction and seat of the fracture, several of these symptoms are wanting, or first occur some time after the accident. In reference to the distinction of the fracture within and without the capsular ligament, according to A. COOPER, it may be observed that the former usually happens in old persons, in which case the *trochanter* is less projecting; nor can rotation upon its axis be so perfectly performed, and the limb is about an inch or two shorter; the latter, on the contrary, happens commonly in younger persons and after much greater violence, the *trochanter* is drawn forward and upwards, the crepitation upon slighter movement of the limb is more distinct, the pain more severe, the swelling greater, the shortening less and rarely exceeding an inch. These signs are not, however, always present, as they depend on the direction of the fracture, and the tearing of the fibrous covering of the neck of the thigh-bone, and on the simultaneous tearing of the muscles. EARLE, SMITH, and others, have therefore given the least shortening *within* the capsule as from a quarter of an inch to an inch, and *without*, as an inch and a half to two and a half inches. In locking-in of the upper end of the fracture into the shaft of the lower, or if the head of the thigh-bone be shattered and the neck locked in between the fractured pieces, (EKL,) the patient feels great weakness in the limb, and can only move a little, even though limping and with pain; the pain is fixed specially at the upper and inner part of the thigh, and comes on especially in bending and straightening; bending is only effected with difficulty. FRICKE found the thigh very movable, and felt crepitation, but which was deficient in firm locking. The shortening of the extremity is inconsiderable, (FRICKE, however, found it to the extent of an inch,) and not removed by extension; the foot is *straight*, directed *inwards* or *outwards*, and may be rotated in the opposite direction. The *trochanter* retains its position, and in rotation moves with the thigh, but without crepitation. If violent extension be employed (as by DELPECH in a case which, on account of the direction of the foot inwards, was incorrectly supposed to be dislocation) the locking is separated, and the foot thereupon falls outwards.

Upon the inlocking of the broken ends in fracture of the neck of the thigh-bone, in addition to DESAULT, DELPECH, and A. COOPER, may also be compared A. EKL (*a*), FRICKE (*b*), HAHN (*c*), JÆGER (*d*). I have seen one case of locking in fractured neck of the thigh-bone, in which the upper was so thrust into the lower end that the great and little *trochanter* were for the most part destroyed.

The rotation of the foot *outwards*, first observed by PARÉ, and after him by J. L. PETIT, but disputed by LOUIS, was subsequently noticed by DESAULT, DESSAUSSOY, DELPECH and many others, but its cause variously explained. The usual cause is generally held to be an oblique fracture through the great *trochanter*, stretching into the little *trochanter*, so that the muscles adhering to the former have the preponderance

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(*a*) Bericht über die Ergebnisse im chirurgischen Klinikum zu Landshut, 1826.

(*b*) Annalen des Hamburg Krankenhauses, vol. ii. p. 286.

(*c*) Würtemb. Correspondenzblatt, 1836, No. 26.

(*d*) Above cited, p. 320.

and cause the inaction of the *m. gluteus medius*. According to GUTHRIE (*a*), the inversion of the foot does not depend on fracture within the capsule; but this sign is rather diagnostic of a fracture through the great *trochanter*, when part of it remains connected with the shaft. J. SYME (*b*) presumes that the inward turning of the foot occurs in cases in which the fracture near the head divides part of the great *trochanter*, where the muscles which draw it outwards are attached, and that part remains fixed to the middle portion of the bone upon which the middle gluteal muscle is attached. STANLEY supposes that rotation of the foot inwards occurs in fracture within the capsular ligament when *that* part of the capsule remains uninjured, which corresponds to the front of the neck. According to DUPUYTREN and A. COOPER, rotation inwards happens when the fracture of the neck is from without inwards and from behind forwards, so that the point of the lower fractured portion projects forwards, and of the upper, backwards. MERCIER (*c*) supposes that the rotation of the foot depends entirely and alone on external causes; on the position given to the limb, in putting the patient on his bed, perhaps also on the accident; then it may be that the patient in falling on his hip, fell more backwards than forwards, and that the great *trochanter* was driven in the corresponding direction. The rotation inwards does not depend on anatomical relations; for, 1. There do not exist any which can produce it; nearly all the muscles endeavour to produce the opposite direction, and all the relations mentioned by writers can at most only render them favourable. 2. All the relations and causes are contradicted by various and even opposite facts; for this inward rotation has been observed in fractures both within and without the capsular ligament, in fracture of the neck, and in fracture immediately below the great *trochanter*, of which MERCIER has given an example. 3. Apart from the pain caused to the patient, we may very easily manage to bring the foot from within outwards, and the contrary. 4. If, when lying on the back, the patient will incline outwards, the foot previously turned inwards, an effort of the will is required, to make the whole limb perform the necessary half circle on the heel. The difficulty is very remarkable if there be only a slight bending of the limb at the knee-joint. If in a healthy state an effort be necessary for this purpose, how happens it that when the thigh is broken, especially when the muscles which rotate outwards, can no longer act? The limb must therefore remain turned inwards when that is the position given to it. LARREY assumes rotation of the foot inwards in every such inlocking of the broken ends, an opinion which, although confirmed by many observations as those of DELPECH, is generally without foundation.

The *diagnosis* of fracture of the neck of the thigh-bone is otherwise generally easy; the crepitation which is frequently very obscure, becomes usually so much less so than the other signs of fracture already noticed, and the motions of the limb which are necessary to produce crepitation, endanger greater irritation, and especially in extensive tearing of the fibrous covering of the neck of the thigh-bone.

A separation of the head of the thigh-bone from the neck consequent on external violence, when ossification is incomplete, which is possible only in young subjects in which the epiphysis is not yet consolidated to the rest of the bone, is in no respect distinguished from the fracture within the capsular ligament (1).

[(1) A case of this kind I have at present (Aug. 1845) under my care, in a boy of ten years of age who fell out of a first floor window upon his left hip. The foot was slightly turned out, and scarcely any difference in the length of the two limbs could be observed. The thigh could be readily moved in any direction and without much pain; but on bending the knee and rotating the limb outwards a very distinct dummy sensation was frequently felt, as it seemed within the hip-joint, as if one articular surface had slipped off another, which led me to suppose that the head of the bone had been broken from the neck through the epiphysis within the capsule. Two days after my colleague GREEN carefully examined the case with me and agreed in the opinion I had formed of it. The boy himself suffered so little inconvenience that he had two or three times got out of bed and walked about for a short distance. He was put upon a double inclined plane, the presumed nature of the injury not seeming to require further treatment.—J. F. S.]

671. Fracture of the neck of the thigh-bone is distinguished from *severe contusion of the hip-joint* in the length of the limb, in the latter case, being unchanged if put in the same position as the sound one; in the

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(*a*) Remarks on the Diagnosis and on the Inversion of the Foot in Fracture of the neck and upper part of the Thigh-bone; in Med.-Chir. Trans. vol. xiii. part i. p. 103.

(*b*) Case of fractured Femur, with Inversion of the Toes; in Edinburgh Medical and Surgical Journal, April, 1826, p. 308.

(*c*) Gazette Médicale, vol iii. Second Series. No. 36. 1835.

absence of crepitation and by the usual circular movement of the great trochanter in rotation of the limb. It is distinguished from *dislocation of the thigh-bone outwards and upwards and outwards and downwards*, by the turning of the foot inwards, which always accompanies these dislocations, but in this fracture is very rare, and even then less complete than in dislocation; the foot also, when in fracture there is inversion, is more easily, though with pain, drawn outwards and lengthened. It is distinguished from *dislocation upwards and inwards*, in which the foot is directed outwards, whereby, as especially in dislocations, the limb becomes very immovable, and it is impossible, without great violence, to restore it to its natural position; the dislocated head can also be felt.

[In the examination of thigh-bones, instances have been often met with, in which from the diminution of the length of the neck of the thigh-bone, in old persons especially, it has been thought that such had been fractured and were united by bone. In reference to this point, ASTLEY COOPER observes:—"The neck of the thigh-bone in old persons is sometimes undergoing an interstitial absorption, by which it becomes shortened, altered in its angle with the shaft of the bone, and so changed in its form as to give an idea, upon a superficial view, of its having been the subject of fracture, so as to lead persons into the erroneous supposition of the bone having been partially broken and re-united." (p. 124.) GULLIVER, however, has shown (*a*) that the same appearances may be observed in younger persons, and he gives several remarkable instances, all of which followed injury to the hip, although at the time the patients were not materially influenced by the blow; but limping and shortening of the limb from shortening of the neck of the bone gradually came on. The most striking examples are the case of the soldier Fox, (p. 99,) who had fallen down a ship's hold five years prior to his death; and also the case of the soldier LYNN, (p. 315,) who met with the accident in the same way, but continued his duty without inconvenience for three years, after which he gradually became lame, and in the course of eighteen months was entirely unfit for service; soon after he was bitten by a poisonous snake and died. In both these instances examination of the parts after death was made, and the neck of the thigh-bone found much shortened, together with spreading of the head.—J. F. S.]

672. The opinions of Surgeons on the *prognosis* in fractures of the neck of the thigh-bone are very different. Some believe that a greater or less degree of limping is in this accident an irremediable consequence; others that bony union is impossible; others consider this fracture as differing only from others in the difficulty of its treatment. A. COOPER admits bony union of the fracture external to the capsular ligament, but considers, that in fracture within the capsular ligament, it does not take place with callus, on account *of the absence of proper apposition and connexion of the fractured ends*, (wherefore also no continued apposing pressure of the two broken surfaces can take place, although the proper length of the foot is preserved,) on account *of the low degree of vital activity*, *on account of the want of activity in the head of the thigh-bone to produce bone*, and on account of the *extension of the capsular ligament by the increased quantity of synovial fluid*. A. COOPER held bony union possible only in those cases in which the fracture passes through the head of the thigh-bone, and the end itself is not completely separated, or the bone is broken without tearing of its *periosteum*, or of the surrounding ligament, or when the fracture has an oblique direction and is partially within, partially without the capsular ligament. A. COOPER has never otherwise seen bony union of the fracture within the capsular ligament. These reasons, which had even earlier been advanced, were contradicted by BOYER, and more recently by EARLE; experience also has proved that

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(*a*) Cases of Shortening of the neck of the Thigh-bone, with remarks; in Edinburgh Medical and Surgical Journal, vol. xlvi. p. 97, and p. 313. 1836.

bony union may take place in these cases (*a*). That this has hitherto in England been little observed may depend on the very careless treatment of fractures known to be within the capsular ligament. The condition of the head of the thigh-bone has nothing to do with it, but rather the difficulty of keeping the fractured ends for a proper time in sufficient contact; frequently, in complete tearing of the fibrous covering of the neck of the thigh-bone, or in bad constitution, or old age, of the patient, is the union of the broken ends often protracted or entirely prevented. Sometimes the upper end is enclosed by bony masses growing from the lower end; and though commonly considerable mobility remains, yet the motions of the limb are very much interfered with. The broken ends are often connected by a fibrous mass which is not sufficiently firm to sustain the weight of the body; the lameness is considerable, and the shortening of the limb gradually increases. The broken ends frequently wear away by rubbing against each other; suppuration in the cavity of the joint takes place, and death soon follows. Sometimes, if one or other of the broken ends be worn by rubbing, and both surfaces become like ivory, a cartilaginous capsule is formed by the thickening of the fibrous covering of the neck of the thigh-bone for the reception of the lower piece of bone, which is capable of supporting the weight of the body.

In v. Soemmering's rich collection there is a preparation of a fracture within the capsular ligament closely united by callus. I possess a similar one, which I had treated in an old woman.

The kinds of union just mentioned have been confirmed by Colles' observations on eleven cases (*b*).

Cruvelhier (*c*) supposes that the callus is produced by ossification of the parts surrounding the broken ends, of the *periosteum*, and of the muscles, which at first become cartilaginous and afterwards bony. Hence it follows that the broken bone which on one side only is covered with soft parts, upon that only enjoys a bony union, and that when no soft parts lie around the broken parts of the bone, no union by bony substance takes place. In the former condition are the knee-cap and *olechranon,* in the latter the neck of the thigh-bone.

[In St. Bartholomew's Museum there are several cases of fractured neck of the thigh-bone within the capsule united by ligament.

The two following cases prove beyond all doubt the possibility of bony union in fracture of the neck of the thigh-bone, and put an end to the disputes upon this subject which had been long and angrily held by English Surgeons.

Case 1 was Swan's patient, (*d*) a woman of eighty years, who having fallen down, he "believed there was a fracture of the neck of the thigh-bone, although the limb remained quite as long as the other, and he could neither perceive any crepitus nor any altered appearance in its position, except a slight inclination of the toes outwards." (p.15.) She died five weeks after the accident; and on *examination* it appeared that "the greatest part of the fracture of the neck of the thigh-bone, which was entirely within the capsular ligament, was firmly united. A section was made through the fractured part, and a faint white line was perceived in one portion of the union, but the rest appeared to be entirely bone." (p. 17.) This preparation is in the Museum of the Royal College of Surgeons.

Case 2 is related by Stanley (*e*). A young man of eighteen years fell from the top

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(*a*) Brünninghausen, above cited, fig. 2, 4.
Liston; in Edinburgh Medical and Surgical Journal, April, 1820, p. 212.
Langenbeck neue Bibliothek für Chirurgie und Ophthalmologie, vol. iii. p. 121.
Begbie; in Edinburgh Med. and Phys. Jour.
Earle, above cited.
Brulatour, A case of Fracture of the neck of the Femur; in Med.-Chir. Trans., vol. xiii. p. 513. 1825.
Langstaff, G., in Med.-Chir. Trans., vol. xiii pt. ii. p. 487.
Richter, Handbuch der Lehre von den Brüchen und Verrenkungen, p. 314.
Delpech, J., above cited.

(*b*) Fractures of the neck of the Femur, illustrated by dissections; in Dublin Hospital Reports, 1818, vol. ii. p. 384.

(*c*) Anatomie Pathologique, pt. xxiii. pl. 1, 2.
Bauer, in Heidelberger klinischen Annalen, vol. iii. pt. i. p. 155.—Howship, J., in Med.-Chir. Trans., vol. xix. 1. London, 1835.

(*d*) An Essay on Tetanus, &c. London, 1825. 8vo.

(*e*) Case of bony union of a Fracture of the Neck of the Femur, within the Capsule, occurring in a young subject; in Med.-Chir. Trans., vol. xviii. 1833.

of a cart on his right hip. "He was wholly unable to move the limb, and suffered severe pain when it was moved by another person. The thigh was bent to a right angle with the *pelvis*, and could not by any means be extended. Abduction of the thigh was difficult. The limb was everted, at first slightly, afterwards in a greater degree. The soft parts around the hip-joint were considerably swollen. There was no shortening of the limb, but rather the appearance of a lengthening of it in the erect posture, probably from the obliquity in the position of the *pelvis*. No crepitus could be felt in any movement of the limb." (p. 256.) It was thought from the patient's age not to be a fracture of the neck of the bone; but under the supposition of it being a dislocation into the *foramen ovale*, the pulleys were applied and forcible extension made. Two months after he was admitted a patient into St. Bartholomew's Hospital, and at the end of the subsequent month he died of small-pox. On *examination*, "the capsule of the hip-joint was found entire, but a little thickened. The *ligamentum teres* was uninjured. A line of fracture extended obliquely through the neck of the *femur*, and entirely within the capsule. The neck of the bone was shortened, and its head, in consequence, approximated to the *trochanter major*. The fractured surfaces were in the closest apposition, and finally united nearly in their whole extent by bone. There was an irregular deposition of bone upon the neck of the *femur*, beneath its synovial and periosteal covering, along the line of the fracture." (p. 258.) This preparation is in the Museum at St. Bartholomew's Hospital, where I have had the opportunity of examining it, and in addition to the above account I may add that nearly half of the head of the bone projects free beyond the hind surface of the neck and forms a well-marked inner boundary to the trochanteric pit.

In this Museum there is another example of bony union, in which the broken head having dropped, its upper part is driven into the neck, which is less shortened than usual, and the lower third of the head descends free below the neck.

In the same Collection there is another preparation in which the heads of both thigh-bones are considered to have been fractured and united by ligament, and there certainly is a distinct and narrow line apparently of ligamentous character which marks the presumed place of fracture in each; but I must confess I have some doubts of these having been fractures, for the appearances so nearly tally in the two that I am inclined rather to think they must be the remains of the epiphysal junction, of which they occupy the precise place.—J. F. S.]

673. *Setting* a fracture of the neck of the thigh-bone is easy in so far as extension only of the limb is requisite to restore its natural length; we cannot, however, be thereby satisfied of the close contact of the two broken ends. Fixing them in close contact till their consolidation, is in no fracture more difficult.

674. The setting is to be performed in the following manner:—One assistant fixes the *pelvis*, placing his hands on the spinous processes of both hip-bones; another makes extension at the foot, and brings the limb at the same time into its natural position. The Surgeon assists the rotation of the limb, and placed on the outside of the thigh, raises the *trochanter*, in order to lessen its pressure on the fibrous covering of the neck of the thigh bone, and to press the lower end of the bone against the upper.

The arrangement of the bed in fractures of the lower extremities requires particular attention. The bed should not be more than three feet wide, and should not be provided at the foot with a high board. Instead of feather bed a firm mattress should be used; and for the support of the head a single pillow. Under the patient should be placed a folded sheet for the purpose of carefully raising him in the necessary movements. To the cieling of the room a rope should be fixed, at the end of which, hanging opposite the patient's chest, a cross handle should be attached, by which he may take hold. The patient-lifter proposed by LEYDIG (*a*) is the most convenient for lifting a patient from one bed to another, or to another place.

675. Fixing the broken ends has been attempted by various bandages and machines, in which, (without employing the earlier practice of fastening

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(*a*) Der Krankenheber, seine Anwendung und Vortheill vorzuglich bei Behandlung der Brücheder unteren Gliedmassen; with two copper-plates. Mainz, 1824. 4to.

the feet to the lower, and the upper part of the body to the upper part of the bed, and the simple contentive apparatus,) either permanent extension is produced by the extended position of the limb, or the limb is kept in a half-bent position with or without extension.

The simple *contentive apparatus*, and fastening with the *spica coxæ* (Paré); with two chaff pillows on both sides of the limb, fixed with straps (Sabatier); by tying both feet together with a pad between the thighs (Guyot) (*a*) by concave splints of tin, wood, leather, and the like (Fabr. Hildanus, La Faye, Arnaud, Duverney, Hedenus, Théden, Bötticher); by a pelvis-belt, and bending the thigh on a splint placed in the ham, and binding the feet together (Bernstein); by enveloping the limb with compresses and an eighteen-tailed bandage, by straw splints on both sides of the limb, enclosed in a wide napkin, fastening of the outer straw splint with a broad pelvis-girdle, and along the limb with bandages (Larrey) (*b*), are not sufficient in true fractures of the neck of the thigh-bone; they can only be employed in cases in which, for the above-mentioned reasons, there is but little shortening or inlocking of the upper fractured piece.

676. To the machines for extension of the limb in the directly straight position belong—

1. Desault's *Apparatus*.—The essential point of which is, that after the whole limb has been swathed in Scultetus's bandage, a permanent extension is kept up by means of a splint reaching from the crest of the hip-bone to beyond the sole of the foot. At the upper end of this splint is fastened a long pad, which is applied on the inner upper side of the thigh, and at the lower end a similar one, which is applied over the ankle. Besides this, a second splint is to be placed on the inner side, and a third on the front of the limb, which last is to descend from the groin to the knee; between these splints and the limb chaff pillows are to be placed, and the splints fastened with five straps; the outer splint especially, by a girdle running round the pelvis.

Van Houte's alteration of Desault's splint is for the purpose of keeping up extension in the long axis of the limb by means of a cross board connected at right angles with the splint (*c*). Similar to this, except that to the cross board an inner splint is fastened, is Volpe's machine (*d*). Also Josse's (*e*) apparatus, with a peculiarly arranged bed. Meyer's (*f*) machine. Physick's (*g*) apparatus, in which the external splint is continued to the arm-pit; that of Houston (*h*); also Alban's (*i*) machine, which consists of a strong splint fixed on the outside of the ailing limb and to the pelvis: the extension is effected by means of a kind of lever contrivance at the lower end of the splint. Gressley's (*k*) apparatus.

2. Brünninghausen's *Apparatus*.—A soft cotton strap is first applied upon a soft pad, over the ankle of the ailing limb, and carried like a stirrup around the sole of the sound foot. To prevent the rotation of the limb outwards, a suitable splint of padded tin or lacquered leather is to be applied on the outside of the thigh, and fastened with a padded bandage around the pelvis and knee. Bending of the knee-joint on the sound side is to be prevented by a gutter-like splint, which should extend from the middle of the thigh to the middle of the leg.

(*a*) Journal Hebdomad. vol. xiii. p. 30.

(*b*) Journal compl. du Dict. des Sciences Médic., pt. xxx. p. 96; Recueil des Mémoires de Chirurgie, Paris, 1821, p. 271.

(*c*) Aver der breuck van den Hals des Dijebeins. Rotterdam, 1816.—Chirurg. Kupertaf., pl. lxxxii. f. 2.

(*d*) Chirurg. Kupertaf., pl. lxxxii. f. 4, 5.

(*e*) Répertoire Générale d'Anatomie et de Physiologie Chirurgicales. 2e. Tufn. 1828.—Froriep's Chirurg. Kupfert., pl. ccxiii.

(*f*) Die doppelte Ausdehnungs-Schiene zur Heilung des Schenkelhalsbruches. Würzb. 1826; with one copper-plate. 4to.

(*g*) Froriep s Chirurg. Kupfert., ccxiv. f. 10.

(*h*) Ib. pl. cccli. f. 1.

(*i*) Langenbeck's neue Bibliothek für die Chirurgie und Ophthalmologie, vol. i. p 262.

(*k*) Mémoire sur un nouvel Appareil pour les Fractures du Col du Fémur. Paris, 1832.—Velpeau, Examen d'un nouvel Appareil imaginé par Gresley. Paris, 1832.—Froriep's Chir. Kupf., pl. ccxc.

3. **Boyer's** *Machine.*—This acts in the same manner as **Desault's** apparatus, only the extension is kept up in a direction corresponding with the long axis of the limb; by means of a screw the extension may be increased or diminished, and the power of extension distributed over a large part of the leg. **Heyne** has altered this machine.

4. **Hagedorn's** *Machine* consists of a strong wooden splint reaching from the crest of the hip-bone to the sole of the foot, and furnished with a transverse piece. It is applied on the side of the sound limb, and fastened with padded straps around the pelvis and extremity. The foot of the sound and that of the ailing side are both fastened to the cross piece, and thus the injured limb preserves its proper extension. **Dzondi's** (*a*) improvement of this machine consists in the splint extending above the crest of the hip-bone to the side of the chest, and the bandages for extending the ailing limb being applied above the ankle and below the knee.

Nicolai's machine (*b*), that of **Klein** (*c*), and that of **Gibson** (*d*), of **Beck** (*e*), **Schürmayer** (*f*), and of **Weckert** (*g*), are all to be considered as modifications of **Hagedorn's** machine.

677. Various plans have been attempted to keep the limb in the bent position.

1. By **Sauter's** (*h*) *Suspensory Machine.* The pelvis is thereby fixed; the tubercle of the haunch-bone is the special point for counter-extension; the extension is made from the foot with a long pad connected to the foot-board.

2. After the setting of the fracture is completed, both feet are to be bound together, for which purpose a bandage is to be applied spirally, from the instep to the knee; a firm pillow is then to be put under the knee so as to bend the thigh at the knee and hip-joint, and the spiral turns are to be continued to the upper third of the thigh. The upper part of the body should be raised rather high, and inclined forwards (**Mursinna.**) Or a firm pillow may be put into the ham of the limb, bent at the hip and knee joints, which is to be kept in this position by a folded cloth carried over the lower part of the thigh and leg, and fastened on both sides to the bed. (**Dupuytren, Richerand.**)

3. **A. Cooper**, in fracture *without* the capsular ligament, keeps the limb half bent, putting it upon a wooden machine, consisting of two pieces of board fastened together at an angle, and corresponding with the bend of the knee-joint. A long splint, laid upon the outside of the thigh, is to be fastened by straps on the side of the great *trochanter*, and buckled on above the knee, and around the pelvis. In fracture *within* the capsule, a pillow should be laid beneath the whole length of the ailing limb, and a well-rolled pad in the bend of the knee-joint, and in this manner the foot kept extended from ten to fourteen days, till the pain and inflammation have passed by. Then the patient should get up daily, and sit on a high stool, in order to diminish the painfulness in bending the limb. After some days he may go on crutches, subsequently with a stick, and in a few months he is generally capable of using his foot, without any further sup-

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(*a*) Beiträge zur ervollkommnung der Heilkunde, part i. Halle, 1816. 8vo.; with plates.

(*b*) Journal für Chirurgie und Augenheilkunde von v. **Graëfe** und von **Walther**, vol. iii. part ii. p. 260. pl. ii. f. 1–9.

(*c*) Ibid., vol. iv part i. p. 17; pl. i. f. 1–6.

(*d*) Ibid., p. 189. pl. i. f. 7–13.

(*e*) **Froriep's** Chirurg. Kupfert., pl. 350, f. 7.

(*f*) Ibid., pl. 350. f. 2–6.

(*g*) Ibid., pl. 319.

(*h*) Anweisung die Beinbrüche der Gliedmaassen, vorzüglich die complicirten und den Schenkelhalsbruch, nach einer neuen, leichten, einfachen und wohlfeilen Methode ohne Schienen sicher und bequem zu heilen. Constanz., 1812; with plates.

port. In every doubtful case the treatment should be as if the fracture were without the capsular ligament.

4. **Earle** has proposed a peculiarly constructed bed for the bent position, in which, by the weight of the pelvis, counter-extension, and by the attachment of the foot to a foot-board, the proper length and position of the limb are preserved, and the relief of natural needs made possible, without moving the patient.

Hereto belong also the machines of **Amesbury** (*a*), **Smith** (*b*), **Koppenstædter** (*c*), **Hager**, and others, in which extension is connected with the double inclined plane.

678. Of all these modes of treatment, I consider the use of **Hagedorn's** machine the best. It is more simple, its operation more certain than that of any other extending machine, and not more troublesome than the double bent position in one or other way, which, excepting the relaxation of certain muscles, has scarcely any advantage, and even renders the limb less secure against motion. **Dupuytren**, however, will have it that by the doubly bent position (*par.* 677) the results are more satisfactory than by any other treatment; inasmuch as in this posture, by the relaxation of the *m. adductor femoris*, the limb loses the disposition to roll outwards, and that this position is accompanied with less inconvenience to the patient than in the extending apparatus (*d*). A. **Cooper's** practice in fracture within the capsule, leaves the impression that the diagnostic marks which he proposes are not always to be depended on. In old persons also, and with all the signs of internal fracture, a perfect cure may be effected by **Hagedorn's** machine, on which point both home and foreign practice agree.

A similar contrivance to **Earle's** bed for preventing motion whilst relieving the bowels, may be added to every mattress; it is however unimportant, as it may be advisable to move the patient daily into another bed (*e*).

679. As in fracture of the neck of the thigh-bone there is always much irritation and contraction of the muscles, if this come on subsequently, it must be attempted to moderate it by rest and antiphlogistic treatment before the application of the extending machine. If permanent extension of any kind be employed, we must always endeavour to keep it up to the same degree; it must only be slackened when the patient complains of pain, and if he cannot bear it another treatment must be resorted to. The patient should keep as quiet as possible during the treatment. The apparatus must not be removed before the sixtieth to the seventieth day, and then the limb should be enveloped in a circular bandage; the patient must remain some time in bed, and must only be allowed to stand up, and, supported by crutches, to move about very cautiously, when, with the leg straight, he can bend the whole limb at the hip-joint. **Dupuytren** assigns to the length of the cure eighty, one hundred, and even a hundred and twenty days.

The weakness and stiffness of the muscles and joint gradually subside; but volatile infrictions and baths may be ordered. Even in the most satisfactory cases, there commonly remains a little shortening of the extremity, which can often be alone observed, on close examination, in the straight posture, but may always be perfectly counterbalanced by a rather thick-soled shoe.

680. When the fracture passes *obliquely through the great trochanter*,

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(*a*) Medical Repository, vol. xix. p. 113.

(*b*) New York Medical and Physical Journal, Oct. Dec. 1825. p. 474.

(*c*) Beschreibung einer neu erfundenen und verbesserten Maschine für alle Arten Beinbrüche. Augsburg, 1823, p. 29.

(*d*) Above cited.

(*e*) **Dzondi**, Lehrbuch der Chirurgie, p. 590.

and the proper neck of the thigh-bone does not participate therein, (which fracture may happen at every period of life,) it is characterized by the following appearances:—the extremity is very little and frequently not at all shortened; it is stiff; the patient is incapable of turning himself in bed without assistance, and the attempt always causes great pain; the broken part of the *trochanter* is in many cases drawn forwards towards the hip-bone, in others it sinks against the *tuber ischii*, but is ordinarily far separated from that part of the great *trochanter* which remains connected with the neck; the foot is turned very much outwards, the patient cannot sit, and the attempt always causes severe pain; crepitation is difficult to be discovered, when the *trochanter* either sinks much backwards or is drawn much forwards. This fracture requires the same treatment as that for fractured neck of the thigh-bone, and unites firmly.

A. COOPER (*a*) gives a proper bandage, which consists of a broad cloth, enclosing the hips, and sewn together; at the point where it passes under the great *trochanter*, it is widened with a piece let in, and padded; behind the great *trochanter* a wedge-like pad is to be placed, so that when the bandage is sewn the *trochanter* may be kept in place. At the same time a thick wedge shaped pillow is to be put under the upper part of the thigh, and the foot fastened in such way that it cannot turn either inwards or outwards.

B.—OF THE FRACTURE OF THE THIGH-BONE BELOW THE GREAT TROCHANTER.

POTT, P., General Remarks on Fractures and Dislocations; in his Works, vol. i. Edition of 1783.

RICHTER, C. F., De situ femoris crurisque fracti laterali minus apto. Lipsiæ. 1788. 8vo.

DESAULT, Œuvres Chirurgicales, vol. i. p. 219.

BELL, C., A System of Operative Surgery founded on the basis of Anatomy. 2 vols. London, 1807-9. 8vo.

SAUTER, above cited.

681. This fracture happens either in the *upper*, *middle* or *lower third* of the thigh-bone; but is most common in the middle. Its cause is either violence acting directly on the thigh, or a fall upon the knee or foot; in the former case it is always accompanied with much bruising, frequently with splintering. The direction of the fracture is in old subjects mostly oblique; in young persons and children usually transverse.

682. The signs are, fixed pain at the seat of fracture, sudden incapability of the patient to move the thigh, unnatural motion in its continuity, deformity of the limb in reference to its length, thickness and natural direction; distinct crepitation on moving the thigh.

The upper fractured end is drawn less upwards and forwards in fracture of the upper than in that of the middle third; the lower end is drawn backwards and upwards at the same time; the lower end is turned outwards, partly by the contraction of the muscles, partly by the proper weight of the limb. If the broken surfaces do not touch, the limb is shortened, especially if the fracture be very oblique. In transverse fractures, specially in young persons, the broken surfaces often remain in actual contact, and the thigh is curved forwards by the contraction of the muscles. In fractures in the lower third, which are mostly oblique, the lower end is drawn backwards towards the ham and the condyle upwards, in consequence of which the knee assumes a peculiar form, and the point of the upper fractured end may penetrate the *m. rectus* and through the skin.

(*a*) Above cited, p. 158.

683. Fracture of the thigh-bone is always a severe accident, as the broken ends are retained in proper contact with great difficulty. The cure takes place most commonly with deformity and shortening of the limb, especially in oblique fractures, and those which occur in the upper and lower third of the thigh-bone. Compound fractures are so much more difficult to treat.

[In simple fractures of the thigh-bone except with great obliquity I have rarely found difficulty in retaining the broken ends in place, and in effecting the union without deformity and with very little and sometimes without any shortening. For the contrary results the medical attendant is mostly to be blamed, as they are usually consequent on his carelessness or ignorance.

Compound fracture of the thigh is a very serious accident; its danger depends upon the injury of the soft parts and extent of the wound, and also upon the obliquity of the fracture and its disposition to drive through the wound or among the muscles. These are points which must be well weighed in deciding whether amputation should be performed or not. If the patient be young and healthy we may often undertake the cure without amputating, and with fair prospect of a happy result.—J. F. S.]

684. The difficulty of retaining the broken ends in complete contact till consolidation is effected, has led to various modes of treatment.

1. The *Contentive Apparatus, with splints, and the limb in a straight position.* The setting is to be effected by extension and counter-extension, as in fracture of the neck of the thigh-bone (*par.* 674.) The Surgeon, standing on the outside of the thigh, endeavours, with both hands, to bring the broken ends into their proper place, and to equalize all irregularities. The apparatus is to be slipped beneath the limb, kept in a proper degree of extension. It consists of five double bands, a piece of linen, as long as the limb, and sufficiently broad to include the splints on both sides, of SCULTETUS's bandage, of three splints, and their corresponding chaff pads, of which one should extend from the crest of the hip-bone to beyond the sole of the foot; the second from the upper inner part of the thigh, just as far; and the third from the groin to the knee. At the seat of fracture two wetted compresses are to be applied, which should surround three-fourths of the thigh; the whole limb is then to be swathed in SCULTETUS's bandage, from below upwards, and the splints rolled up in the piece of linen on both sides, till they are brought to two to three fingers' breadth from the limb. The interspace is then filled up with the pads, the third splint laid with the chaff pad upon the front of the thigh, and the splints surrounded with the bandages, of which three are to be put on the thigh, and two on the leg. The foot should be supported in a stirrup (1). This apparatus is to be wetted from time to time with lead wash, replaced every six days up to the fiftieth, or, in old people, to the sixtieth day (2). If the callus have become sufficiently firm, which is known by the patient being able to raise the limb freely, rendering it some support with his hands at the fractured part, the apparatus may be removed, the whole limb enveloped in a circular bandage, and the patient allowed to go about carefully with crutches for several days.

[(1) In general, I think the straight position in treating fracture of the shaft of the thigh-bone is far preferable to either of the other methods. But the plan I employ is rather different from that here advised. I use four splints, flat pieces of deal about one-sixth of an inch thick, and three or four fingers wide, which any carpenter can quickly furnish; the hind one should reach from the tuberosity of the haunch-bone, against and immediately below which it should rest, to within four inches of the sole, so as to be quite free of the heel; the front one should extend from just below the groin, not quite so low as the bend of the ankle-joint, and should have two or three transverse saw-tracks where it rests upon the knee-cap so that it may not press it severely; the inner splint should extend from the *perineum*, and the outer from the great *trochanter* to the sole of the foot, and a large hole made in each corresponding to the ankle. All the splints should be thickly padded and have their ends well defended with the pads. A SCULTETUS's bandage of sufficient length to cover the whole limb and foot having then been laid upon the padded hind splint, the limb is to be gently lifted, and the splint having been put behind it up to the tuberosity of the haunch-bone, the limb is placed upon it, gentle extension made, the bandage and side splints applied, and then the front one, after which all the splints are tied together with three bands upon the thigh and two upon the leg. If there be any disposition to spasm or dragging up the lower part of the fracture, a sand-bag may be attached for two or three days to the foot; after which it is rarely needed. I prefer this to most other apparatus, because the patient is generally very easy with it, and is capable of moving about a little in the bed without disturbing the fracture.

(2) The plan here proposed of replacing the splints after every six days is faulty, as being liable to produce disturbance of the fracture. They are best left alone as long as possible, except so far as merely tightening the bandages when they become loose. If the case do well, it is rare that the splints need reapplication more than once or twice during the cure. It must be remembered, however, that, under these circumstances, the fracture has not been set till after the subsidence of all swelling, during which time the limb is merely laid upon a pillow.—J. F. S.]

2. The *Apparatus with splints, with the limb bent, and lying on the side or on the back.* The bent position of the limb was proposed by POTT, for the purpose of relaxing the muscles of the thigh. The ailing thigh is to be laid on its outer side, with the knee-joint half bent; the whole of the patient's body should be inclined to the side. The setting is perfected in this half bent position. The apparatus consists of two splints, placed on the hinder and fore part of the thigh, and attached with the eighteen-tailed bandage. The whole limb rests on a pillow. As with this apparatus the motions of the knee are not interfered with, the position does not tend to the perfect relaxation of the muscles, and imperceptibly the upper part of the body sinks down in the bed straight by which displacement of the broken ends is favoured, the bent position has been changed, and, as in fracture of the neck of the thigh-bone, (*par.* 677,) the limb is put on a wooden stage formed of two boards, connected at an obtuse angle, and of which the oblique surfaces require a suitable bending of the limb. These are covered with pillows and provided with pegs on the sides, to prevent the displacement of the limb. When the limb is placed on this stage, the setting is to be completed, the thigh surrounded with compresses, and SCULTETUS's, bandage, and steadied with three splints on the outer, inner, and fore part. (C. BELL, A. COOPER.)

3. The *permanent extension* may be employed either on the plan of DESAULT, as in fractured neck of the thigh-bone; or after BRÜNNINGHAUSEN, also as in fracture of the neck of the thigh-bone, except that together with the outer splint, a second is to be applied on the inner, a third on the front, and a fourth on the back of the thigh. If both extremities be connected at the foot and knee, according to BOYER and HAGEDORN, as in fractured neck of the thigh-bone; or according to SAUTER, in which case the permanent extension is made whilst the limb is bent, and the limb kept suspended.

Here also EARLE's bed (*par.* 677) is suitable, and the apparatus proposed by GRANGER (*a*), for the purpose of connected permanent extension with a double inclined board. For the same purpose is MOSSISOVIC's (*b*) equilibrium plan.

(*a*) Edinburgh Medical and Surgical Journal, April, 1821. p. 194. f. i. ii.

(*b*) Darstellung der æquilibrial-Methode zur sicheren Heilung der Oberschenkelbrüche ohne Verkurzung. Wien., 1842.

BLUME, Einfache Beinbruchmaschine zur Heilung der Schenkelbrüche in gebogener Lage. Würzburg, 1831; with one plate.

The permanent apparatus is put on by **Seutin** in the following manner:—After the bed has been properly arranged, bandages, a straw cloth, **Scultetus**'s bandage in three or four layers of strips sufficiently long to reach once and a-half round the limb, are to be laid upon it. The swathing of the foot is now to be commenced with the stirrup bandage from the root of the toes, which remain uncovered, and at the same time serve as an index to determinine the position of the bone. The first layer of bandages is then as usual to be applied from below upwards, and then plaster of Paris spread over it. This acts merely for the gluing of the second layer, without by its hardness injuring the skin. The second layer is to be applied in a similar manner, and an assistant smears it over with plaster with a large brush. The pasteboard splints are then cut to fit, broadest at the back part of the thigh and calf. At the edges of the foot they are; to be cut with two broad pieces, which, connected in the middle, form a sole, and reach only to the lateral projections of the head of the first and fifth mid-foot-bones. A single sole does not give sufficient firmness, though one sole may be put on, and the ends of the pasteboard splints made to overlap it. The pasteboard splint must not press the edge of the shin-bone, and should be sufficiently wide that there may remain behind and before a finger's breadth between their edges. In the edges of the splints, notches should be made with the shears, or indents, which are still better, whereby they stick closely to the underlying parts. The pasteboard splints should be soaked in water, spread with plaster, applied, and at once overspread on both sides with a thick layer of plaister, so that in drying they form as firm a substance as a wooden splint; and now the third layer of bands is applied The foot is then to be somewhat raised, and a conical pillow stuffed with tow, placed between the heel and calf, to keep the hind part of the apparatus perfectly horizontal, and to diminish the dropping through of the heel and calf. The heel-pad is also to be spread with plaster, and fixed in the fourth layer of bandage; or it may be applied earlier between the bandage straps, so that subsequently it is not necessary to raise the limb higher. As it is important that the **Achilles**' tendon should not be compressed, two pieces of the same compress should therefore be previously laid on both sides of it. The lower part of the splint, which bends over the sole of the foot, is fixed within a circular bandage. As till the complete drying of the apparatus, displacements easily occur, straw splints are usually applied by means of straw splint cloth, and the whole firmly bound with rollers, as in the common contentive apparatus. The assistants, who have hitherto kept up extension and counter-extension may now let go the limb. If the fracture be very oblique and the fractured ends easily separate, a sling must be applied at the lower part of the limb by means of a double bandage, fastened on both sides of the foot and leg, and connected at its end with bags, more or less full of sand, which are allowed to hang down over the foot of the bed, in order that in the perfectly horizontal position of the patient, a continued extension may be kept up, by which necessarily the counter-extension can be made to operate, not merely by the simple weight of the body, but also by a cloth folded longitudinally, carried between the thighs, and fixed to the bed's head. On the day after the drying of the apparatus, the straw splint-cloth and the straw splints are to be removed, and a circular bandage applied from the foot to the hip. Two or three days after the patient may be allowed to go with crutches, in which case the foot should be supported by a bandage slung round the neck.

685. In transverse fractures in the middle of the thigh a simple apparatus with splints and the limb put straight are sufficient. In fractures of the upper and lower third, the half-bent position is preferable on account of the special displacement of the broken ends (*par.* 682); and in fracture in the upper third immediately under the great *trochanter*, a position approaching the sitting posture is preferable, because thereby only can the lower end be kept in corresponding position with the upper end of the fracture. But it must be here observed whether the fracture be not so near the joint and connected with such injury that stiffness will ensue, in which case the straight position with or without tension according to circumstances must be employed. The half-bent position of **Bell** and **Cooper** is preferable to **Pott**'s posture on the side.

686. In oblique fracture this treatment is rarely sufficient, as the broken surfaces after having been apposed cannot be kept in contact. In these cases the permanent extension is necessary, and in fractures in

the middle of the thigh, is best effected by the machines of **Boyer** and **Hagedorn**; but in fractures of the lower and upper third, the machine of **Sauter** or the double inclined plane are especially serviceable on account of the advantages connected with the half-bent posture.

If the fracture be complicated with wound, one or other position may be advantageous as may best suit the care of the wound.

687. In children, after properly setting the fracture, it is usual to swathe the whole limb up to the hip in a circular bandage, several turns being made round the seat of fracture. Pasteboard splints are then to be applied on the outer, inner, fore and back part of the limb from the groin to the foot, swathed in a roller, and the whole wrapped in a cloth to protect the apparatus against displacement. The application of the common contentive bandage is, however, more suitable, because it can be more easily renewed and without changing the position of the limb.

688. If much inflammation and swelling have set in, they must be treated according to the rules laid down, (*par.* 587.)

689. The management of the patient during the cure of the fracture is directed by the general rules. Stiffness of the joint after the cure, especially if the fracture be near the knee-joint, is often of long continuance, but gradually subsides with motion and with volatile rubbings-in.

690. In rare cases, the *outer or inner condyle of the thigh-bone may be broken obliquely*, or *it may be separated by a vertical cleft* which descends from a fracture. This is distinguished by the great swelling of the knee-joint, by the deformity, and by the crepitation observed in the movements of the condyles. It is difficult in these cases to prevent deformity, and great interference with the motions of the joint. The limb is to be put straight on a pillow and the inflammation sought to be repressed with leeches and cold applications. This done, a simple contentive bandage is to be applied. If in an oblique fracture with separation of the condyles, the upper end of the fracture be driven out through the coverings, amputation of the thigh is indicated.

XVI.—OF FRACTURE OF THE KNEE-CAP.

(*Fractura Patellæ*, Lat.; *Bruch der Knieschiebe*, Germ.; *Fracture de la Rotule*, Fr.)

Meibom, Dissert. de patellâ ejusque læsionibus. Francf., 1697.

Bücking's Abhandlung von Kniescheibenbruche nebst der Beschreibung einer neuen Maschine. Stendal, 1789.

Sheldon, On Fracture of the Patella and Olechranon. London, 1789.

Camper, P., De fracturâ patellæ et olechrani. Cum fig. Haag. 1790. 4to.

Desault, above cited, vol. i.

Boyer, above cited, vol. iii. p. 291.

Cooper, A., above cited, p. 200.

Alcock, Observations on the Fracture of the Patella and Olechranon. London, 1823.

Ortelli, Dissert. de fracturâ patellæ. Berol., 1827.

Fest, Dissert. de fracturâ patellæ. Berol., 1827.

Lachmund, Inaug. Abhandl. über den Bruch der Kniescheibe und die Zerreissung des Knieschiebenbandes. Würzb., 1838.

Dupuytren; in Leçons Orales de Clinique Chirurgicale, vol. ii. p. 297.

691. *Fracture of the Knee-cap*, has most usually a transverse, rarely a longitudinal, and often a more or less oblique direction; or the bone is split to pieces. In the former case it may be consequent on violent contraction of the muscles attached to the knee-cap in violent bending of the leg; in other cases it is always produced by direct external violence and is accompanied with great contusion, with effusion of blood into the joint, or with wound.

692. The *diagnosis* is easy. There has been previous violent tension whilst the knee was bent, to preserve the equilibrium of the body, or a fall upon the knee whilst the leg was bent; the patient feels severe pain, often hears a crack, and can neither stand up nor stretch out his foot after the fall. In transverse fracture a space is distinctly felt between the two ends of the bone, which are separated, the upper piece being drawn upwards. This separation is the greater, the more the fibrous covering of the knee-cap is torn, and may extend to four or five inches; but it is lessened when the leg is straightened. Crepitation is not observed because the broken ends cannot be brought into immediate contact. In vertical, oblique, or splintered fractures of the knee-cap, the separation and mobility of the broken ends and crepitation are felt on examination.

693. The union of the fractured pieces is effected by means of a *fibrous intersubstance*, the cause of which does not depend on the sponginess and isolation of the bone, nor on the want of blood between the fractured surfaces, nor on the intrusion of the *synovia*, and paucity of vessels in the bone and surrounding parts, but on the difficulty of retaining the fractured ends in sufficiently close contact. The opinion, however, that in transverse fracture the consolidation does not depend on callus, is unfounded and disproved by experience (*a*). In splintering of the knee-cap, the broken ends are usually connected by callus. If the intersubstance which effects the union be not very broad, the motions of the joint are scarcely hindered, but under contrary circumstances the gait is more unsteady. If with fracture of the knee-cap there be severe bruising or a wound of the joint, the injury is always important, as *anchylosis* or suppuration of the joint with fatal consequences may ensue. Even in simple fracture, by the use of unsuitable and especially of too tight bandages, destruction of motion, union of the upper part of the knee-cap with the front of the thigh-bone, with atrophy of the ligaments and extending muscles may occur, which is worse than if a broad intersubstance had been formed.

From Gulliver's observations (*b*), it appears, 1. That if the aponeurosis be completely divided as is the case in fracture from muscular contraction, a bony union is not to be expected; 2. In transverse fractures in which bony union is deficient, the fragments and the interposed fibrous tissue are well provided with vessels; the want of union, therefore, is not to be ascribed to imperfect nourishment; 3. If the union in transverse fractures be effected by fibrous substance, there is often a bony deposit on the ends of the bone, so that the fragments have the appearance of two symmetrical bones; 4. Bony union is simply the result of immovable adjustment of the fragments which, in many cases of fracture, the uninjured state of the aponeurosis on the fore part effects; 5. New bones, which in fracture of the knee-cap seem to be formed of the broken pieces. The surrounding cellular tissue rarely or never becomes converted into bone; the fibrous tissue goes directly to the production of new bone. No cartilaginoid substance appears during the ossification.

(*a*) Dupuytren; in Ammon Parallele der französischen und deutscher Chirurgie, p. 151. Langenbeck, neue Bibliothek für Chirurgie und Ophthalmologie, vol. iii. pt. i. p. 49.

(*b*) Edinburgh Medical and Surgical Journal, 1837. No. 130.

694. In *transverse* fracture, the two broken ends are in general easily brought into perfect contact, if the joint be completely straightened, the hip bent, so that the thigh forms an obtuse angle with the axis of the body, and the broken ends pressed together with both hands. If the broken ends be not far apart, that position of the limb is favourable to the cure, in which it is supported on a pillow laid beneath it, upon which it is to be closely pressed with a cross cloth carried round over the lower part of the thigh and fastened on both sides to the bed; or the whole limb is put upon a machine in which the foot is fixed to a foot-board, and motion at the hip-joint can be restricted at pleasure. This is even to be considered as the most proper mode of treatment, as after it less stiffness of the knee is to be expected than after the use of bandages (*a*).

The close union of the fractured ends may also in this position be further assisted by properly applied strips of adhesive plaster (*b*).

695. In considerable separation of the broken pieces, a special bandaging is, however, necessary, which should counteract the contraction of the muscles, and press together the two ends of the fracture, in order to produce union with the smallest possible interspace. After the coaptation of the fractured ends, as already directed, two long pads are to be applied above and below the knee-cap, so that their ends may cross in the ham. By means of a single or double-headed roller they are to be so fastened that a figure of ∞ is formed around the knee-joint. On the front of the limb is put a strip of linen, four fingers wide, somewhat longer than the limb, with two clefts in its middle, corresponding to the seat of fracture. This is to be fixed, its lower end being somewhat enveloped by spiral turns from the ankle to the knee. The remainder of the roller, with the loose strip of linen, is to be given to an assistant, and a second strip of linen, split to its middle into two heads, applied upon the front of the thigh, and fastened with another roller carried in spiral turns from the groin to the upper part of the knee-cap. The circular bandage is then given to an assistant, and the head of one strip of linen brought through the cleft of the other, both drawn in opposite directions, and their two ends turned in and fixed with the continuation of the spiral turns. The extremity thus placed has a splint laid behind the ham, in order to prevent the motion of the joint.

Langenbeck (*c*) puts the extremity in a horizontal posture, allows the patient to sit, and envelops the leg with ascending, and the thigh with descending spiral turns, to the two fragments of the knee-cap.

[I cannot agree with **Chelius** in the use of this bandage, for the pressure necessarily made upon the front of the broken knee-cap will be very irksome, if not painful to the patient. It is far better, after fixing the circular pads above and below the knee-cap, to draw them together on each side with a tape; by doing which, as the pads are brought together, so is also the upper part of the knee-cap brought down to the lower without any pressure being made on the front of the bone.—J. F. S.]

696. Besides the apparatus mentioned, which best serves the purpose, numerous bandages and apparatus have been proposed, but which for the most part have the objection that they do not counteract the muscles, which draw up the upper fractured piece, nor press equally strongly upon both upper and lower broken end, in consequence of which the

(*a*) **Flajani**, Medicinisch-chirurgische Beobachtungen, Nürnberg, 1799, vol. ii. p. 151.
Richerand, Histoire des Progrès récents de la Chirurgie, p. 142.
Dupuytren; in **Ammon**.

(*b*) **Alcock**, Practical Observations on Fracture of the Patella and of the Olechranon. London, 1823.

(*c*) Above cited.

patient cannot bear them. To these belong the bandages and apparatus of **Bücking** (*a*), **Evers** (*b*), **Mohrenheim** (*c*), **B. Bell** (*d*), **Boyer** (*e*), **A. Cooper** (*f*), **Baillif** (*g*), **Fest** (*h*), and many others.

697. If, as is generally the case, inflammation and swelling immediately set in together, they must be first got rid of by proper treatment, the joint being kept in the position already described, (*par.* 694,) before proceeding to set the fracture, and to the application of bandages. As often as the apparatus becomes loose, it must be reapplied; in seven or eight weeks' time it may be removed, but the patient must still be very careful in moving about. The longer the patient remains quiet, the sooner bony union takes place. A stiffness of the joint frequently continues, which only gradually subsides; often incurable *anchylosis* ensues (1). The latter seems to arise from the application of the bandages, before the inflammation of the joint is got rid of. If the intersubstance be very wide, the knee must be supported with an elastic bandage. The motions of the limb in these cases may be also often improved, if gradual and more violent motions of the leg be performed, by which the contracted *m. rectus* again lengthens itself to a certain degree (2).

[(1) I have never seen *anchylosis* of the knee-joint from fracture of the knee-cap, and can only imagine its occurrence under very peculiar circumstances.—J. F. S.

(2) **John Hunter** observes:—"Other things are to be done after the union has taken place. First, the accommodation of the muscles to their new situation, where less length is necessary, from the *patella* having become longer; secondly, the new contraction in this new situation; thirdly, acquiring sufficient strength in it. We have reason to believe that the greatest contraction in a muscle is somewhat greater than the joint will allow of; for we find them firm when the limb is stretched, as if the power was greater; and when the part is deprived of this firm band, we find the muscles draw the bone up higher than they should. Thus the upper part of the *patella* is always drawn up when the bone is broken. While the union is taking place, the muscles are accommodating themselves to the great length of the bones. After this it will be necessary to bend the limb and keep it so, in order that the muscles may be thus enabled to admit of an elongation equal to the flexure of the limb, by which means the patient will be enabled easily to bend the limb. Extension will not be so easy; still, by perseverance, it may be acquired." (p. 512.) He then mentions a case in which the broken pieces of bone having been left far apart, the patient had lost the use of her limb, although it could be swung backwards and forwards as she sat upon a high table; and he considered that he cured her simply by inducing her to direct her will to the excitement of the action of the *rectus* muscle. And he explained how this was effected, first, by reference to the condition of the muscle, "that the space between the two attachments of the *rectus* being much shortened, while the muscle continued of the same length, the utmost degree of its contraction would scarcely be able to straighten itself, much less move the *patella* and leg also." And then, that "if the influence of the mind was frequently exerted on the muscle, it would gain this power of contraction, in which it would probably be aided by the interstitial absorption taking place, and actually shortening the muscle, and suiting its length to the office it was to perform." (p. 513.) In other words, and more briefly, the object is to produce in the *rectus* muscle a recovery of its tonicity, by educating it to contract and permanently shorten itself, so that it may re-acquire the power of acting on the knee-cap, and extending the leg which it previously had, but of which it is deprived by the ascent of the broken part of the knee-cap rendering it lax instead of tort when the leg is straight.

I believe the best mode of recalling the *m. rectus* to its proper function is, after having kept the patient in bed five or six weeks, by which time it may be presumed whatever union will, has taken place, to get him up, place him on a table, with his ham on its edge, and direct him to swing the leg backwards and forwards, frequently during the

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(*a*) Above cited.

(*b*) **Richter**'s chirurg. Biblioth., vol. x. p. 153.

(*c*) Beobactungen verschiedener chirurgischen Vorfälle, vol i. Wien, 1780.

(*d*) Lehrbegriff der Wundarzneikunst, vol. iv. p. 430. pl. iv. f. 1, 2, 3.

(*e*) Above cited, pl. iii.

(*f*) Above cited, pl. ix. f. 9, 10, 11.

(*g*) **Ortalli**, De fracturâ Patellæ. Berol., 1827, p. 52.

(*h*) Dissert. de fracturâ Patellæ. 1827. 4to.

day. At first he can do this very little, not because, as HUNTER and CHELIUS suppose, the *m. rectus* is too short and requires lengthening, but on the contrary because it is too long and must be instructed to shorten itself still more, so as to compensate for the approximation of its points of attachment by the unnatural space between the broken ends of the knee-cap. When the muscle has re-acquired sufficient power to throw the leg and foot forwards, then some weights must be attached to the foot, and the same exercise continued till the muscle can freely move it when so loaded. In this way the muscle becomes shortened, and capable both of sustaining the erect posture and throwing the leg forwards. It may be here observed, that if the fibro-ligamentous union of the broken pieces of the knee-cap be long, the patient's gait is very odd, the foot and leg are not carried forward steadily and set on the ground, but as it were jerked or thrown forward from the knee, and when the foot rests on the ground and the weight of the body is transferred to that limb, the knee is in an extreme state of extension, as if supported almost entirely by the posterior ligament of the joint.—J. F. S.]

698. The *longitudinal* fracture requires merely a common contentive bandage, which may compress the broken pieces on their sides, with a less elevated position than in transverse fracture.

The *splintered* fracture requires the same apparatus as the transverse, when the broken ends are displaced upwards, or as the longitudinal fracture if they be displaced at the side; but here also the inflammation and swelling must be first got rid of, before the aplication of the apparatus.

If fracture of the knee-cap be accompanied with wound of the joint, it must be treated according to the general rules of compound fractures.

[Compound fracture of the knee-cap almost invariably requires amputation, as the injury producing it is so severe that there can be little expectation of a satisfactory issue.—J. F. S.]

699. If the *ligament of the knee-cap* be torn, the knee-cap ascends, and the treatment must be the same as in transverse fracture. I have employed this same practice in five cases with the happiest success. I once observed, in a weakly man, in whom the ligament was torn on the left side, and from improper treatment the bone was displaced upwards five inches, a tearing of the fleshy fibres of the *m. rectus*, which had occurred from a false step, and from the attempt at preserving the equilibrium of the body, consequent on muscular contraction. The seat of rupture is distinctly felt, of which the space becomes greater on bending the leg, and is diminished by straightening it. The application of the prescribed apparatus was successful.

Although the apparatus above mentioned is most suitable for transverse fracture of the knee-cap and rupture of its ligament, it must, however, be observed that its application must be made with the greatest accuracy and attention, as also its readjustment when the bandages are loosened, in which special care must be taken that the broken ends be not displaced, and the scarcely-formed union disturbed and destroyed. In this respect it were perhaps convenient to spread the above-described apparatus with plaster, and thereby render certain its lasting close application.

XVII.—OF FRACTURE OF THE BONES OF THE LEG.

(*Fractura Ossium Cruris*, Lat.; *Bruche der Knochen des Unterschenkels*, Germ.; *Fracture des Os de la Jambe*, Fr.)

POTT, P., above cited.

DESAULT, above cited, p. 270.

BOYER, above cited, p. 324.

700. ***Both bones of the leg*** **may be broken at once, or the** ***shin-bone*** **or** ***splint-bone*** **may be broken separately. The fracture is produced either by a fall upon the feet, or by the operation of direct violence.**

701. If the *shin-bone alone be broken,* (*Fractura Tibiæ,* Lat.; *Bruch der Schienbein,* Germ.; *Fracture du Tibia,* Fr.,) the fracture has usually a transverse direction, and may happen in the middle or at either end. The broken ends are rarely displaced, and then only according to the thickness of the limb. This happens so much less frequently, the nearer the fracture is to the upper end of the bone. The *diagnosis* is, therefore, often difficult; the patient frequently can walk after the injury; he feels a fixed pain; an irregularity is often discovered at one part of the shin-bone, and often crepitation on moving the broken ends. The *treatment* of this fracture is easy; a slight extension is sufficient, if the broken ends be displaced, to put them right, and a simple contentive apparatus, as recommended in fracture of both bones of the leg.

702. *Fracture of the Splint-bone* (*Fractura Fibulæ,* Lat.; *Bruch der Wadenbein,* Germ.; *Fracture du Péroné,* Fr.) may be produced by an inward or outward turning of the foot, or by the immediate effect of violence; and the fracture may be either in the body of the splint-bone, or in the neighbourhood of the outer ankle. In fracture of the body of the splint-bone the limb is not shortened, and retains its natural direction; a slight yielding is scarcely felt at the seat of fracture in pressing the finger along the bone. The violence received on the outside of the leg, and the great ecchymosis assist the *diagnosis.* This fracture is frequently accompanied with dislocation inwards of the shin-bone, and if it be mistaken, the foot retains its disposition to dislocate after seeming reduction. The inner ankle always again leaves the joint surfaces of the *astragalus,* thrusts the skin violently inwards, which becomes inflamed, breaks, and even runs into mortification. The broken end may alone be displaced, and driven inwards against the shin-bone. If the seat of fracture be very low down, it may be discovered by the touch, which is not possible in the upper third of the splint-bone. Crepitation is often observed on pressing the fractured ends inwards, or in alternate adduction and abduction of the foot. The most striking sign is always the *inclination of the foot outwards,* so that its inner edge is downwards, and the outer upwards. If dislocation of the shin-bone inwards be connected with this fracture, the bone is shorter, its long axis falls on the inner side, the whole shin-bone lies obliquely from above inwards, and produces beneath the skin, especially at the lower part, a considerable prominence. The splint-bone follows the same direction as the shin-bone to the seat of fracture, from which it is directed obliquely outwards. The foot is not only inclined outwards, but so turned upon its own proper axis, that its sole is turned up, and its inner edge directed downwards. Fracture of the splint-bone may also be connected with dislocation of the foot outwards, often simultaneously with fracture of the inner ankle or of the shin-bone, and other complication may exist, as, in dislocation of the ankle-joint, will be more particularly described.

703. The *treatment* of simple fracture of the splint-bone is unattended with difficulty. The foot must be kept bent inwards, to separate the broken ends from the shin-bone. This is effected by the same apparatus as that for fracture of both bones of the leg, with this difference, that the inner splint is applied only to the inner ankle, but the outer continued below the outer ankle. Or, upon the inside of the leg is put a folded chaff pad, the bottom of which rests on the inner ankle, and the upper end upon the inner condyle of the thigh-bone. A sufficiently strong wooden

splint is fixed upon this pad with a circular bandage, so that its lower end may project from four to five inches beyond the sole of the foot. With a second roller the foot is drawn inwards towards the shin, the bandage being turned like a ∞ around the shin, foot, and ankle-joint (*a*). This apparatus, however, has the objection that it frequently becomes displaced, or presses too tightly. In five or six weeks the fracture is consolidated. In fracture connected with dislocation of the foot, the splint-bone must, after reduction of the dislocation, be kept in place by the prescribed apparatus, and by a general and local treatment according to circumstances, to which often very important symptoms are opposed.

704. Fracture of *both bones of the leg* (*Fractura Cruris*, Lat.; *Bruch der beiden Knochen des Unterschenkels*, Germ.; *Fracture des deux Os de la Jambe*, Fr.) is either transverse or oblique, and may be either in the middle, upper, or lower third. The *diagnosis* is always easy. The displacement of the broken ends, according to the length of the limb, is more rare, than that according to its straight direction and circumference; but, in oblique fractures, the leg is always shortened, the lower end turned outwards and backwards, the upper inwards and backwards. Only when the fracture is near the top of the leg, is the upper fractured end drawn much upwards and backwards by the operation of the bending muscles. Very frequently, particularly in oblique fractures, the broken ends protrude through the skin.

705. The *treatment* varies as the fracture is transverse, oblique, in the neighbourhood of the knee-joint, or connected with injuries of the soft parts.

706. In *Simple transverse Fracture* the setting is always easy. One assistant holds the limb above the knee, and another at the heel and instep; slight extension is generally sufficient to bring the broken ends into place. As they have little disposition to displacement, the simple contentive apparatus is sufficient. Two moistened square compresses are to be put upon the leg, and to surround two-thirds of it; it is then to be swathed, from below upwards, with SCULTETUS's bandage, wooden splints, three fingers wide, are to be applied on both sides, which should reach beyond the knee and ankle-joints, in a sufficiently large piece of linen, and they should be two fingers distant from the leg. This space is to be filled with chaff pads, a smaller pad and splint are to be put on the front of the leg, which should reach from the tubercle of the shin-bone to the ankle, and the splints are to be fastened with three double bands, of which that on the seat of fracture should be first tied. A compress is to be put on the sole of the foot, and crossed on the instep, and by its ends attached to the apparatus. The leg should so rest on a chaff pad, that it may easily be bent at the knee-joint; and care should be taken that the heel lie in a proper hollow. At first the apparatus should be moistened from time to time with a dispersing lotion, and renewed every six or eight days. On the fortieth or fiftieth day the consolidation is perfected, when the leg may be enveloped in a circular roller.

707. The *oblique Fracture* of the leg is also generally set with ease, though the mere contentive apparatus is not sufficient to keep the broken ends in proper place, as they have not any opposite support, and are,

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(*a*) DUPUYTREN, Mémoire sur la Fracture de l'extrémité inférieure du Péroné, les luxations et les accidens qui en sont la suite; in Annuaire medico-chirurgical des Hôpitaux et Hospices de Paris. Paris, 1819. 4to.—Leçons Orales de Clinique Chirurgicale, vol. i. p. 189.

therefore, very easily displaced. Posch's (*a*) foot-bed or Sauter's (*b*) machine serves best for permanent extension.

708. In fractures of the leg near the knee-joint, the setting is best managed in the half-bent position, which is the most proper during the cure. The contentive apparatus is to be applied with this difference, that one splint is to be put in front, another upon the inner, and one upon the back of the leg, which should lie on the outer side, or on a double inclined bed. If the head of the shin-bone be broken obliquely into the knee-joint, the leg must be kept straight, fixed by the contentive apparatus, and stiffness prevented by early motion.

709. Fracture of the leg is frequently connected with a wound produced by external violence, or by tearing of the soft parts by pieces of bone being driven outwards. In the latter case the wound must be enlarged, and often the piece of bone sawn off, in order to effect the proper replacement. The seat and direction of the fracture determine the kind of apparatus. The simple contentive bandage has in these cases the disadvantage of requiring frequent renewal, on account of attending to the wound. Here the suspensory apparatus, in which the limb lies free, and the wound can be properly attended to, is best. Braun's (*c*) machine is merely a suspendor, and can therefore principally serve in those cases only in which the broken ends, after being set, have no disposition to displacement. When this is the case, Posch's foot-bed, with Eichheimer's (*d*) improvement, or Sauter's machine, best answer the purpose. These two machines have the advantage that they not only suspend the leg, but also keep it permanently extended.

Seutin's permanent apparatus for fracture of the leg may be easily modified from that for fracture of the thigh. The thigh part is not required; the apparatus, however, must be applied of sufficient length upon the broken parts. In fracture near the knee-joint, it must therefore reach over the lower part of the thigh-bone. As in the leg there is little danger of separation, the patient may lie in winter upon a sofa at the fire, and in summer he may sit in the sun, so that the bandages may dry in twelve hours, if there be no special disposition to inflammation in the joint.

[The treatment of fracture of the leg, when either one of the bones only is broken, is very easy, the unbroken bone forming the best and most efficient splint which can be provided. And indeed if the patient be quiet, there is no real necessity for splint or bandage of any kind, which, however, it is necessary to apply to quiet the anxiety of the patient and his friends. If, however, both bones be broken, they must be kept in place by apparatus of some kind or other. If wooden splints be used, one on each side is sufficient, and the leg is best laid upon the side, with the knee half bent to relax the muscles, and the tip of the great toe so raised as to be on the same level with the knee-cap. I do not think that usually there is any necessity for the application of a third splint along the shin. Especial care must be taken that the edges and ankle-holes of the splints are well covered, so as to prevent their digging into the skin and forming tiresome sores. Some prefer the straight posture with the leg resting on the heel, but I think the bent is more agreeable to the patient. In the common transverse fractures of the leg, my colleagues and myself almost invariably use the gum roller, without either splints or fracture-box, and with very great success, as well as comfort to the patient, who is not then confined to his bed more than six or eight days, but allowed to be about on crutches. The plaster of Paris apparatus of Seutin, or the white of egg and flour splints with starch roller, may either of them be used in this fracture advantageously; but they occupy more time in their application, and we now seldom use them. Oblique fracture

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(*a*) Beschreibung einer neuen, sehr bequemen Maschine, das Fussbett genannt, zur Heilung des Schienbeinbrüches. Wien, 1774. 8vo.

(*b*) Above cited.

(*c*) Metzler Beschreibung der Braun'schen Maschine zur zweckmässigen Lage einfacher und complicirter Beinbrüche der unteren Gliedmassen. Ulm, 1800.

(*d*) Beschreibung und Abbildung einer Maschine für einfache und complicirte Beinbrüche des Unterschenkels, welche nach der Posch und Braun'schen Maschine construirt, die Vortheile desselben vereinigt, nebst einer Vorrichtung, welche bei dem Transportiren solcher Patienten gebraucht werden kann; with five lithographed engravings. München, 1821. 8vo.

is usually very tiresome when both bones are broken, and in general cannot be managed with the gummed, starched, or plastered apparatus, nor by placing the limb on the side. In these cases it is almost always necessary to have the leg straight and resting on the heel, with a pair of side splints, and constant extension by weighting the foot, as mentioned in the general treatment of fractures, to prevent the riding of the fractured ends and the liability of their protrusion through the skin. Sometimes an Amesbury's or Assalini's apparatus is found most effectual to keep the fracture in place, and at other times the swing-box serves the purpose best. But not unfrequently it is a very difficult matter to keep the fracture quiet and in proper position, and the Surgeon's ingenuity is sorely taxed to conduct the case satisfactorily for the first few days; after which, however, the difficulties generally subside. But as the bones are so close to the skin, this fracture requires more especial attention than any other to prevent the bones driving through.

I have not taken any notice of fracture of the leg-bones accompanied with dislocation, as that subject will be more conveniently treated of at a future opportunity.—J. F. S.]

As to the various kinds of Foot-beds, Swing, and Extending Machines, the following writers are to be referred to:—

Loeffler, Beiträge, vol. i.

Prael, in Arnemann's Magazin, vol. iii. part ii.

Faust, Beschreibung einer Beinbruchmaschine zum Gebrauche der Feldlazarethe. Bückeburg, 1815.

Schmidt; in Loder's Journal, vol. iv. part iii.

Koppenstaetter, Beschreibung einer neu erfundenen und verbesserten Maschine für alle Beinbrüche der oberen und underen Gliedmassen ohne Binden, Schienen und Strohladen, nebst ausführlicher Anleitung zur unfehlbaren Anwendung derselben. Augsburg und Leipzig, 1823. 8vo. Second Edit.; with one copper-plate, containing 34 figures.

Von Graëfe's Suspendor; in Journal für Chirurgie und Augenheilkunde, vol. iv. part ii. p. 197.

An alteration of Prael's, for the purpose of obtaining with the swinging position an alternate lateral posture, by Nusbaumer; in Annalen für die gesammte Heilkunde. Karlsruhe, vol. ii. part i. p. 60. 1825.

Mayor, Mémoire sur l'Hypopartécie; ou sur le Traitement des Fractures par la planchette. Paris. Genève, 1827.

Dornblüth, L., Bemerkungen über die gebrauchliche Behandlungsart der Unterschenkelbrüche, nebst Beschreibung eines Schwebe-und Streck-Apparates, womit jene ohne Binden und schneller als bisher zu heilen sind. Neustrelitz, 1827. 8vo.; with a lithographed plate.

Elderton; in Edinburgh Medical and Surgical Journal. 1824, March.

Amesbury, On the Nature and Treatment of Fractures, &c. London, 1827.

Förster's Suspendor; in Richter's Handbuch der Lehre von den Brüchen, u. s. w. p. 450–452.

Rilke, Beschreibung der Fritze'schen Beinbruchschwebe. Prag., 1823.

Speyer, Beiträge zur chirurgischen Heilmittellehre und Krankenpflege. Hanau, 1835.

On the Plaster of Paris Apparatus, see Richter, above cited.

XVIII.—ON FRACTURE OF THE BONES OF THE FOOT.

(*Fractura Ossium Pedis*, Lat.; *Bruch der Knochen des Fusses*, Germ.; *Fractures des Os de Pied*, Fr.)

710. The bones of the foot are rarely broken, on account of their great strength and shortness; their fracture therefore, mostly consequent on the immediate operation of external violence, is accompanied with bruising of the soft parts, and with crushing of the bones, and must be treated according to the ordinary rules. In severe crushing, the extirpation of some bones, the excision of the front of the foot, or the amputation of the

leg may be necessary. Fracture of the heel-bone is the only one which requires particular mention.

711. *Fracture of the Heel-bone* (*Fractura Calcanei*, Lat.; *Bruch des Fersenbeines*, Germ.; *Fracture du Calcaneum*, Fr.) is rare, and either consequent on a fall upon the toes whilst the foot is extended, or of violence which affects the heel-bone itself, and is then always accompanied with injury of the soft parts. The *diagnosis* of this accident is not always distinct, because the aponeurosis covering the bone frequently is not much torn. The most important sign is the mobility of the bony pieces sideways. The patient cannot walk nor stand up. In complete tearing of the *periosteum* the upper broken piece may be affected by the contraction of the muscles of the calf, much displacement be effected, and the heel disfigured and pulled up from two to five inches.

Setting this fracture is easy; the foot is to be extended very straightly, the leg much bent, and the upper end pressed down, if it have been much bruised. In this position it is to be fixed, and a compress an inch thick, an inch broad, and an inch and a half long, is to be applied and fastened with a roller an inch broad and double-headed, which, its middle placed on the compress, is to have its ends passed round and crossed on the sole of the foot, then upon the instep, and the crossing repeated on the compress, and the turns in this way continued till the bandage is expended. On the front of the leg and instep a moderately bent splint is to be attached. The apparatus recommended in tearing of the ACHILLES' tendon (*par.* 566–571) may be also employed. Perhaps, in most cases, the application of the bent splint upon the instep, and swathing the leg up to the knee is the best treatment. In six or seven weeks the fracture is consolidated; really about the same manner as in fracture of the knee-cap.

[Fracture of the heel-bone is a very rare accident. LAWRENCE (*a*) mentions a single case which occurred under his care; the person jumped off a stage-coach and "fractured the *os calcis*, breaking the posterior part of the bone which was drawn up by the muscles of the leg. There was an obvious displacement of the bone, an inequality which rendered the nature of the accident perfectly clear. When the knee was bent and the foot extended so as to relax the muscles completely, a crepitus was felt between the broken fragments of the bone." The case did well, "the knee being kept bent and the foot extended by a splint fastened along the anterior surface;" he had, "however, for a while, something of a halting gait when he walked." (p. 323.)

In the Museum of St. Bartholomew's Hospital there is a specimen of horizontal fracture of the tuberosity of the heel-bone just beneath the insertion of the ACHILLES' tendon extending to its hinder upper joint surface, where it is continued upwards at nearly a right angle, the fracture piece does not, however, appear to have been actually pulled out of place. I do not know if there be any history connected with it.

LISFRANC (*b*) mentions the case of "a woman fifty years old, who, in consequence of a fall on her feet, broke the upper hind part of the heel-bone. When he first saw her a phlegmonous erysipelas had attacked the leg and foot, no contentive apparatus could be applied, and only after twenty-nine days could bandages for uniting the wound be employed; and three months elapsed before the broken pieces of the bone could be brought into contact. At the end of a month the wound of the soft parts had scarred, and then the bony fragments appeared to have united by a fibrous substance analogous to that formed in fractures of the knee-cap, and permitted some motion. But after three weeks this mobility disappeared, probably, says LISFRANC, because this intermediate fibrous substance had become ossified." (p. 109.) It is not stated whether this case was a compound or simple fracture, but I presume from the description it must have been the former. I have had one case of compound fracture of this bone, in 1838, by a cart-wheel passing over the foot; a clean cut wound extended from the inner ankle across the front of the ankle-joint backwards, downwards, and below the outer ankle near to the insertion of the ACHILLES' tendon, exposing the tendons, the

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(*a*) Lectures in Lancet, 1829–30, vol. ii.

(*b*) Archives Générales de Méd. vol. xvi. 1828.

superficial branch of the peroneal nerve, and having the heel-bone projecting through it. This bone was entirely deprived of its shell excepting its articular surfaces, but the hinder one for the *astragalus* was broken. The shell of the bone was fractured into numerous pieces of various size, and the ACHILLES' tendon was partially detached. Amputation was recommended, but to this she would not submit; and therefore, after removing all the loose pieces of bone, I brought the edges together, with the view of producing adhesion. Sloughing, however, ensued, and she died exhausted on the sixth day after the accident.—J. F. S.]

[711.* The toe-bones can never be broken without very considerable violence, and, in consequence of their shortness, are rather crushed than broken. Whether simple or accompanied with wound, they are best treated by wrapping up in a poultice, and rest, without any bandaging. If the soft parts be much injured, the whole toe generally sloughs, so that it may be as well to amputate at once, especially as the gait is not much affected thereby. This, however, does not apply to the *great toe*, which is a very important part of the foot, and a very principal agent in walking, and therefore should be amputated only under circumstances of absolute necessity; as by its removal not only considerable halting is produced, but the pressure made on the scar induces ulceration and great inconvenience. A pasteboard splint, if the fracture be simple, attached with some slips of adhesive plaster, is sufficient; and the patient should be kept quiet and not allowed to bear on his foot. If the fracture be compound, it is best to apply a poultice, under which the wound heals either by quick union or by granulation; and when the scarring has taken place, then a pasteboard splint or a gum roller may be applied for the completion of the cure.—J. F. S.]

II.—OLD SOLUTIONS OF CONTINUITY.*

A.—ON SOLUTIONS OF CONTINUITY WHICH DO NOT SUPPURATE.

I.—OF UNNATURAL JOINTS.

Hildanus, Fabr., Observationes Chirurgicæ, cent. iii. obs. 91.

Salzmann, De articulationibus analogis, quæ ossium fracturis superveniunt. Argent., 1718.

a Meckern, Job, Observat. Med.-Chir., cap. lxxi.

White, Chas., Cases in Surgery. London, 1770.

Schmucker, Joh. Lrb., Vermischte Chirurgische Schriften. 3 vols. 8vo. Berlin, 1785–97.

Laroche, Dissertation sur la nonréunion de quelques Fractures, et en particulier de celle du Bras, et sur un moyen nouveau de guérir les fausses articulations qui en résultent. Paris, an xiij.

Physick, P. S., in New York Medical Repository, vol. i. p. 122. 1804. 8vo.

Roux, De la Resection ou Retranchement des parties d'Os Malades. Paris, 1812.

Wardrop, in Medico-Chirurg. Trans., vol. v. p. 358.

Boyer, above cited, vol. iii. p. 86.

Langenbeck, Von der Bildung widernatürlicher Gelenke nach Knochenbrüchen; in his neuer Bibliothek für die Chirurgie und Ophthalmologie, vol. i. p. 81.

Oppenheim, Ueber die Behandlung der falschen Gelenke; in **Rust's** Magazin, vol. xxvii. p. 203, has collected all the hitherto known cases of treatment of false joints.

Buchanan, Thomas, An Essay on a new mode of Treatment for Diseased Joints, and the Non-Union of Fracture. London, 1828. 8vo.

Amesbury, Joseph, Practical Remarks on the Nature and Treatment of Fractures, &c. London, 1831. 8vo. 2 vols.

Seerig, De Pseudarthrosi de fracturâ proficiscente. Regiomont, 1838.

Oppenheim, Ueber die Behandlungs weisen der Pseudarthrosen und eine neue Heilmethode derselben; in Hamb. Zeitschrift für die gesammte Medicin, vol. v. pt. 1.

Brodie, Sir Benj., Clinical Observations on Ununited Fractures; in London Medical Gazette, vol. xiv. p. 676. 1833–34.

Reisseisen, De articulationibus analogis, quæ fracturis ossium superveniunt.

712. When the two ends of a broken bone, not united by firm cartilage, are covered with cartilage, or the soft parts have got between them, an

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[* Although, as translator of this work, I am of necessity compelled to follow the course which the Author has thought right to pursue, yet I cannot avoid stating, in reference to this division of his Book, that it appears to me improperly named and misplaced, and far from well arranged and composed in itself. "Old Solutions of Continuity, consisting of those which do not and those which do suppurate." Among the former are included enduring solution of parts which have originated in injury, as unnatural joints and torn *perinæum*, with original imperfect (or as it is the fashion to say, abnormal) formation of parts, as hare-lip and cleft palate, between which there is neither analogy nor connexion. The latter comprehend ulcers of various kinds, which are as various in their times of appearance, from the period at which the action causing them has been set up—and fistulas, which have really (of the three) the only pretension (slight indeed as it is) to be called old solutions of continuity, as they really are none other than a chronic condition of abscess; that is, an abscess which the constitution has not had sufficient power to fill up and obliterate with new parts, although it is capable of sustaining with less or more effect upon itself, the suppurative disposition already established.—J. F. S.]

unnatural joint (*Articulatio præternaturalis*, *Pseudarthrosis*, Lat.; *Widernatürliches Gelenk*, Germ.; *Fausse Articulation*, Fr.) is produced. The broken ends in this case are movable, but the natural motions of the joint are greatly interfered with, or entirely prevented.

[On the subject of unnatural or false joints JOHN HUNTER (*a*) observes:—"'Sometimes simple fractures will not unite at all. This is a worse consequence than any of the foregoing, there being no soft union even, or if there ever was, that being absorbed. Here the surrounding parts thicken and form a kind of capsular ligament, and the extremities of the bone rub against each other at each motion of the limb, by which stimulus the broken parts are absorbed, and the extremities become smooth, and in time are covered with something similar to cartilage, and at length the cavity between them becomes filled with a fluid very much resembling synovia." (p. 504.)]

713. The cause of such unnatural joint may be bad setting of the fracture, improper apparatus, too frequent movements of the limb (1), general disease, and advanced age (*par.* 579) (2). A firm union of the broken ends may also be prevented by particular circumstances under which the bone may be absorbed, and the fractured ends connected only by cartilage. The formation of an unnatural joint depends especially on impeded ossification, on excessive absorption, and the condition of such joint ordinarily presents no actual resemblance to the construction of a natural joint. Frequently, however, the ends of the bone are rounded and enveloped in a thick fibro-ligamentous capsule attached to the ends of the bone, above and below, and its internal surface lined with a smooth membrane, resembling the synovial, and, like it, capable of secretion (BRODIE, GIBSON, AMESBURY) (3). The period at which firm union takes place in fractures is indeed very different (*par.* 578.) An unnatural joint may, however, be considered as formed, *if more than six months have elapsed after the fracture, and the ends of the fracture be still movable.* Unnatural joints have been noticed in almost every bone, but they are most frequent in the upper arm.

[(1) AMESBURY says:—" By far the most frequent cause of non-union that I have noticed is want of rest in consequence of the inadequacy of the plans of treatment which have been employed. I consider this to have been the primary cause in almost all the cases I have examined." (p. 716.)

(2) I do not think advanced age can justly be considered as the cause of want of union or imperfect union, at least as regards the shaft of bones. In almost every ununited or imperfectly united fracture I have seen, the patient has scarcely, if ever exceeded the middle age, but has generally been younger.

(3) Among the causes of want of union, ASTLEY COOPER believes that it " is sometimes the result of continuing cold applications for too long a period to the part, thus checking that degree of inflammatory action which is absolutely necessary to bring about a restoration of the parts." (p. 679.)

Pregnancy has been held to be a cause of want of union, but AMESBURY says he has " seen about ninety cases of non-union, but has not met with more than two which happened during the process of gestation. He is therefore disposed to attribute non-union, in persons so circumstanced, more to the inadequacy of the usual modes of treatment than to the peculiar disturbance of the system which is observed in pregnancy." (p. 714.)

Sometimes after fracture the union of the broken bone is entirely prevented by one end being dragged from the other by muscular effort; such occasionally happens when the spoke-bone being broken just above the insertion of the *m. pronator quadratus*, its lower end is drawn in by that muscle. Sometimes a portion of neighbouring muscle slips between the fractured ends, and getting free, prevents union. At other times, in a comminuted fracture, a fragment dies and as effectually opposes union as a bullet, piece of cloth, or any other extraneous body is occasionally known to do; and this may happen either in simple or compound fracture. A very good example of an ununited simple fracture from this cause occurred within the last twelvemonth to my colleague MACKMURDO, and was discovered at the operation performed for sawing off the

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(*a*) Lectures on Surgery, PALMER's Edition, vol. i.

ununited ends. The fracture was of the upper arm, had happened ten months previously, and been kept in splints six weeks, after which it seemed to have united, but in a few days' time was again broken, whilst the woman followed her usual occupation. The splints were reapplied, but without benefit, and afterwards two setons, at some interval of time apart, were passed by the side of the ununited bone, but not between its ends, and worn for some time, but no union resulted. It was then determined to cut down and saw off the ends of the fracture, and when the incision was made for this purpose, the upper end of the bone was found covered with cartilage, and the lower surrounded with a sort of capsule, containing several loose pieces of bone. These were removed and the ends of the fracture sawn off; suppuration continued for some time, and she left the house at the end of two months, the wound not having scarred, and no fixing of the fracture having occurred. Some time after an abscess formed nearer the elbow, and several small pieces of bone have voided by it, and continue so to do. At present, eight months after the operation, there is not any union.—J. F. S.]

714. According to the variety of the cause of unnatural joints, the mode of *treatment* must vary, to prevent their occurrence. If, however, they already be formed, their cure is only possible by the broken ends, which are covered with cartilage, being put in the condition of a recent division, that is, by producing in them a suitable degree of inflammation, which is sought to be effected *by rubbing the fractured ends against each other, by an apparatus of pressure, by the application of caustic, by sawing off the ends,* and *by the introduction of a seton.*

[JOHN HUNTER proposes a different method from either of these. He says:—"In this case it is necessary to lay open the new cavity and irritate the ends of the bones, and then, by keeping them in position, bony union will often take place. It has been recommended to saw off the ends of the bones; but all that seems necessary is, to irritate them sufficiently to excite a fresh inflammation." (p. 505.) He does not, however, mention any examples in which either of these modes of practice was successful.]

715. *Rubbing the fractured ends together,* (*Exasperatio,* Lat.; *Reibung der Bruchflächen gegen einander,* Germ.; *Frottement des extrémités d'une fracture,* Fr.,) and subsequently fixing them with a suitable apparatus, can only be advantageous during the establishment of the unnatural joint, because afterwards it can seldom produce a sufficient degree of inflammation (1). With the same object it has also been attempted to fix the broken ends by tightly-fitting bandages, for the purpose of exciting inflammation by the patient's standing and walking (2).

[(1) Rubbing the ends of the bone together is at least as old as CELSUS (*a*), as quoted by OPPENHEIM. "Si quando vero ossa non conferbuerunt, quia sæpe soluta, sæpe mota sunt, in aperto deinde curatio est; possunt enim coire. Si vetustas occupavit, membrum extendendum est, ut aliquid lædatur; ossa inter se manu dividenda, ut concurrendo *exasperentur,* et si quid pingue est, eradatur, totumque id quasi recens fiat, magna tamen cura habita, ne nervi musculive lædantur." *Lib.* viii. c. x. sect. vii.

BOYER considers that this coarse and uncertain practice often destroys a callus when first forming, which by longer continued rest and contentive bandaging might have effected a firm union. CITTADINI's case (*b*) of a false joint in the thigh-bone cured by violently rubbing together the fractured ends and by the subsequent application of a contentive bandage, can scarcely be considered to support this practice, as the fracture was only two months old; and, as is well known, many cases unite after as long or longer period of seeming want of union, as completely as under the most favourable circumstances."—J. F. S.]

(2) In cases of this kind I have covered the limb with compresses, and over these applied wet pasteboard splints, so as to enclose it completely; and then employed the usual swathing, with SCULTETUS's bandage, and the common splints with chaff pads, and having made the apparatus sufficiently tight, have left it for a long while.

716. The use of *Pressure* for the cure of artificial joints rests partly on the close coaptation of the broken ends, and the preservation of complete quiet, and partly on the excitement of a due degree of inflammation,

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(*a*) De Medecinâ.

(*b*) In OMODEI Annali Universali de Milana, vol. xxxvii. p. 415, 1826.

The pressure may be employed either with the usual apparatus of splints, as in recent fracture, and at the same time with padded straps and tourniquets upon the fractured ends (*a*), or by simple strong pressure, with swathing of the whole limb, and graduated compresses with tightly drawn rollers (*b*). These modes of treatment, although many cases prove their good effect, do not, however, frequently effect a cure, because the necessary degree of inflammation cannot be produced, and applies rather to cases of not long standing and to those in which no firm intersubstance is formed.

The repeated application of blisters on the surface, opposite the seat of fracture, has been recommended, at six or eight weeks after the occurrence of the accident (*c*). Cauterization of the skin with caustic potash (*d*), and painting with tincture of iodine (*e*).

[I believe that pressure and perfect rest are the most efficient remedy for fractures in which there is tardiness or indisposition to deposit earthy matter in callus; and I have very great doubt whether firm union is ever effected except when its absence has arisen from this deficiency alone. In simple fracture it can only be surmised what the actual cause of the want of union is, and in operating on such cases it appears quite as often that the diagnosis which has been formed is wrong, as that it is right. It must also be remembered that the deposit of earthy matter in the callus is frequently a very slow process, double and treble the time beyond that ordinarily requisite for the purpose, sometimes elapsing before a fracture is perfectly united. Chelius has just mentioned that an unnatural joint may be considered as formed if more than six months have elapsed after the fracture, and the ends of the fracture be still movable. But Amesbury mentions cases which have united by pressure after six, eight, ten, and even sixteen months have gone by. And therefore I cannot but think that these must only have depended on deficient earthy deposit; for cases have occurred again and again in which pressure of all kinds has been employed without advantage, and when operated upon no callus connexion has been found.

That the pressure to be employed in these cases should be sufficiently great and so directed as to bring the fractured ends closely together cannot be doubted, and in fractures which unite slowly is absolutely necessary. But I am not quite sure it is necessary that the pressure should be so great as to produce pain in the course of a few days after the application of the apparatus, as stated by Amesbury, although "in the different cases it differed very much in degree. In some of them it amounted only to a slight aching pain, accompanied with now and then a lancinating sensation in the fracture; but the inconvenience felt in all the cases varied more or less in the course of the day; and I am not aware that in any one of them it was at any period sufficiently severe to affect the pulse—certainly not so as to produce any noticeable fever." (p. 806.)

External irritation in these cases, so far as I have seen, is of little value.—J. F. S.]

717. For the purpose of destroying the cartilaginous surfaces on the ends of the bone, and to produce a suitable degree of plastic inflammation, various kinds of caustic have been employed, strong nitric acid (Ollenroth) (*f*), caustic potash (the younger Cline) (1), (Hewson) (*g*), butyr of antimony (Weilinger) (*h*), and nitrate of silver (Kirkhide) (*i*). Here also belong (Mayor) (*k*) experiments of repeatedly introducing between the ends of the bone a metallic canula, and in it a steel probe dipped in boiling water, and the injection of some irritating fluid into the wound (Hulse) (*l*).

(*a*) Amesbury, Jos., above cited.

(*b*) Wright's three Cases of Cure of False Joints, by a pressure apparatus; in American Journal of Medical Sciences, vol ii. p. 270.

Fleury, Des effets de la Compression dans le traitement de plusieurs maladies externes et surtout dans les Fractures et Fausses Articulations, avec quelques réflexions sur cette dernière maladie; in the Mémorial des Hôpitaux du Midi, par Delpech, Sept., 1830, p. 539.

(*c*) Brodie; in London Medical and Surgical Journal, October, 1823.

(*d*) Hartshorne, Philadelphia Medical Recorder, 1826, April.

(*e*) Buchanan, cited at the head of this article.—Trusen, in Preuss Vereinszeitung, Juni, 1834, p. 114.—Willoughby; in Transactions of the Medical Society of the State of New York, Albany, vol. i. pt. ii. p. 76.

(*f*) Bernstein, über Verrenkungen und Beinbrüche, Second Edit., Jena, 1819, p. 280.

(*g*) North American Medical and Surgical Journal. Philadelphia, 1838, Jan.

(*h*) Rust's Magazin, vol. xxxiv. p. 330.

(*i*) American Journal of the Medical Sciences, Feb., 1835.

(*k*) Nouveau Système de Déligation Chirurgicale, &c. 8vo. Geneva, 1832.

(*l*) American Journal of Medical Sciences, Feb. 1834.

Cases of happy cure of ununited fractures of **White**, **Cline**, **Lehmann**, and **Barton**, are collected by **Oppenheim** and others in **Rust**'s Magazin.

[(1) **Chelius** has quoted **Hewson** as having first proposed the use of caustic potash in ununited fractures. The fact is, however, that it was practised by the younger **Cline** more than twenty years before in St. Thomas's Hospital, in proof of which, I copy from my notes the following

Case.—P. M., a sailor aged thirty years was admitted into St. Thomas's Hospital, *April 13th*, 1815; having on the 7th of September, of the preceding year, fallen down a ship's hold, by which compound fractures of both legs were produced. For these accidents he was received into Chatham Hospital, and there continued till the 1st of March last. During this time the wounds of both legs healed, and the left shin-bone united properly by bone, but the right only by fibro-cartilage. Strengthening plasters and blistering were employed to promote bony union, but without effect.

When first admitted into St. Thomas's, he was directed to walk about for the purpose of exciting the ossific inflammation, but although this was attended with much pain, there was no improvement. Towards the latter end of May, the part was blistered, but without advantage. It was therefore determined to have recourse to an operation, which was performed.

June 12th. The skin was cut through on the inner and fore part of the shin-bone, and the connecting substance, which was solid, being completely laid bare, portions of it were cut away with a small crowned trephine, till the ends of the bone were reached. Into the hole thus formed, caustic potash was introduced, and allowed to remain for a few minutes, after which a poultice was applied. The patient suffered great pain when the intermediate substance was cut into, and indeed was much excited during the whole operation. He had no pain till the evening of the 14*th*, when the leg became very painful, continued so for ten hours, and then became easy. On the 16*th* the pain recurred, and continued for the same length of time, after which it ceased. In a day or two after a free discharge was established, and there was not any return of the pain. On the 21*st* the poultice was left off, adhesive plaster applied, and an outside splint put on to support the leg. On 9*th of July* he got up and walked about on crutches. On the 20*th* he felt that his leg was stronger. On the 27*th* he left the house with the connexion of the broken ends decidedly firmer; but the wound was not healed, and he returned again, *Aug.* 17, with the sore still opened. He continued in the house till *Oct.* 10, and then left, at which time the union was complete.—J. F. S.

Hewson's case was successful, and union was complete in twelve weeks after the operation.]

718. *To saw off the cartilage-covered ends of the fracture*, they must be laid bare by a longitudinal cut on that side of the limb where the bone is most superficial, and the large nerves and vessels can be avoided; they are then to be separated from the surrounding and connecting parts, thrust up through the wound, the soft parts protected by a spatula introduced beneath, and first the lower, then the upper portion of the fracture cut off with a suitable saw. The bleeding vessels are to be tied during the operation; the broken ends are to be brought into contact, and the case is to be treated as a compound fracture. In the after treatment, subsequent to the removal of the ends of the bone, it must be especially remembered not to expect too early the consolidation of the ends of the bone, because, from my experience, this occurs only after a very considerable time. I am convinced that, in many cases, amputation of the ends of a fracture have had an unsatisfactory result from want of attention to this circumstance (1).

If the ends of the bone lie very deep and cannot be easily protruded through the soft parts, it is best to use **Heine**'s osteotome. It is frequently very difficult and even impossible to reach that end of the bone which is overlapped by the other end, and surrounded with much soft parts. In such cases it is advantageous according to **Dupuytren**'s experience to saw off that end which can be reached, and bring it in contact with the other which has not been cut off (**Pigné**). **Brodie** (*a*), in a case of false joint of

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(*a*) London Medical Gazette, July, 1834.

the leg, in which seton and pressure had been used in vain, cut upon the shin-bone, removed the half ligamentous and cartilaginous mass with which the ends of the bone were united, scraped both broken surfaces, and filled the wound up with lint. This was left for three or four days in order to fill the wound with granulations, and then pressure was employed to keep the fractured ends in firm and close contact.

(1) In a case of section of an artificial joint in the upper arm in a young scrofulous man I found the ends of the fracture still quite movable, but complete consolidation ensued two months after under the continued use of the apparatus.

[According to Guido de Cauliaco (*a*), the Arabian physicians recommended cutting down on the fractured part and getting rid of the callus either by rubbing or scraping. "Verum si multum infestitur et aliter fieri non potest, consulet Avicenna incidatur caro et atrosboth (callus) fricando separetur. Si fuerit attritio et timetur membri corruptio, scarpelletur." (p. 45.) This appears, however, from Avicenna's account to have been a very severe and not unfrequently fatal operation.

The operation of sawing off the broken ends of the bone seems to have been first proposed and successfully practised by Charles White (*b*), in 1760, on the upper arm of a boy, nine years old, which had been fractured six months. In his second case, which was a fractured shin-bone, he could only saw off the upper end, behind which the lower had so fallen that it could merely be scraped, and it was found necessary to introduce butyr of antimony, to destroy some muscular fibres between the fractured ends. Both cases did well. This operation has been repeatedly performed, but with very variable success. I think it is only applicable to the upper arm and leg where the bones are not very thickly covered with muscles; but not in the thigh or fore-arm. Lawrence's observations (*c*) on the subject are well worthy of attention. "If the operation be in the fleshy part of the thigh, it must be a very difficult thing to accomplish: you have to inflict a very severe wound, a wound very likely to be followed by considerable inflammation, and that with a still more serious effect. In many instances in which this has been done the patient has at least been left in a worse situation than he was in before." (p. 265.) My friend Green's operation on an ununited fracture of the thigh-bone, detailed by Amesbury (*d*), fully proves the difficulty to which Lawrence refers. "A semicircular incision was commenced about the middle of the *rectus* and then carried round through the belly of the *vastus externus*. The flap was dissected back and the fractured end of the upper portion of the bone brought into view. Upon clearing away the muscles it was seen that the two broken extremities of the bone were connected together by a thick dense capsule, resembling the capsule of the hip-joint, the inner surfaces of which were perfectly smooth and shining. The integrity of this capsule was destroyed, by removing a portion of it from the upper fragment; but in consequence of the difficulty which was experienced in getting at the fractured end of the lower portion, which, as has been said, lay on the inner side of the upper, it was left covered with the ligamentous matter. In removing about half an inch of the fractured end of the upper fragment, which was done by one of Hey's saws, in order to give room, it was found that the bone had become soft and spongy at this part, apparently from interstitial absorption. From the manner in which the ends of the bone lay, it was evident that the lower portion could not be cleared of the ligamentous deposit which covered it, without enlarging the wound in the soft parts, a proceeding which appeared objectionable." (pp. 821, 22.) The greater part of the wound soon healed without any constitutional excitement, but there was suppuration, and the matter burrowing, an abscess was formed at the upper inner part of the thigh, which was punctured. He was immediately placed on a fracture-bed with inclined planes and no splint applied till the tenth day, when one well padded was put upon the outside of the thigh, and worn for seven weeks, but no union was effected. An inner splint was then also applied and the fractured ends pressed tightly together by the web of a tourniquet twisted closely on them and continued for a fortnight. But no advantage was gained; the limb was amputated above the seat of fracture, and the patient did well. On *examination*, it was found that the unnatural joint "was now again complete. The greater part of it was nearly the thickness of the capsule of the hip-joint, but at one part it was thin like the capsule of the shoulder-joint; the capsule was accidentally torn at this part with the finger, and the inner side was seen smooth, and had very much the appearance of synovial membrane, being moist and shiny. The ends of the bone were rounded, and where they came in contact, were flattened and covered with a dense fibrous structure,

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(*a*) Chirurgia Magna. Venetiis, 1498.

(*b*) Phil. Trans., vol. li. 1760. Also in his cases, above cited.

(*c*) Lectures in Lancet, 1829-30, vol. ii.

(*d*) Above cited.

very similar in appearance to the intervertebral substance when divided transversely, but especially that part of it which is found half-way between the centre and circumference." (p. 826.) It appears to me, in regard to this case, that if **White's** treatment had been followed out and the ligamentous covering of the lower end of the bone had been destroyed with caustic the result might probably have been more favourable. As it was, the object of the operation, to wit, that of getting rid of the ligamentous or cartilaginous coverings of the fractured ends was only partially effected.—J. F. S.]

719. The *introduction of a seton* is to be effected in the following manner: —It should be attempted by extension and counter-extension to bring the broken ends into proper position, and even to separate them somewhat from each other. With due caution the place is to be chosen, where the seton-needle armed with silk can be so thrust into and through the whole limb, that no large vessel nor nerves should be wounded, and so that the seton-thread be placed between the two ends of the fracture. It might be better, perhaps, in most cases, to cut down on both sides to the bone, for the purpose of more certainly and accurately carrying the seton through between the fractured ends. The limb should then be duly extended, and kept in proper position by a suitable apparatus. The seton-threads are to be drawn daily backwards and forwards between the fractured ends, and to be entirely removed as soon as the ends are found to be knit together. If, after three or four months, no firm union have ensued, all hope of cure must be given up; there remains then, if the patient will be relieved of the inconvenience of the unnatural joint, no other remedy than amputation.

Weinhold (*a*) himself employed with advantage his needle-trephine with which he introduced a wedge-shaped seton smeared with some irritating matter.

Oppenheim (*b*) recommends, in order to make the operation of the seton more powerful, enduring and effectual, where the circumstances previous to the introduction of a seton had not promised, *à priori*, any result, the introduction of two setons, not indeed as already proposed, through the newly-formed cartilaginous intermediate mass; but in such way that each seton should be in contact with one of the fractured ends: the setons not to be left too long, but only till such time as suppuration was properly established, and then at once withdrawn, instead of by repeated and gradual thinning the size of the seton. In two cases **Oppenheim** pursued this practice with success under the most unfavourable circumstances.

According to **Jobert's** opinion (*c*), the seton should be left in only eight days.

720. The use of the seton may be accompanied with difficulty and danger, when in an oblique fracture the surfaces of the fracture correspond, so that in passing the needle through, important vessels and nerves may be injured. If the fractured ends be so close together that their surfaces touch only at one little point, the proper position of the bone must be first attained by permanent extension, after which by the introduction of the suture some advantage may be gained.

721. The introduction of the seton is more simple and less dangerous than sawing off the ends of the fracture; healing also takes place without shortening of the limb; but in many cases, on account of its less activity, it is not beneficial, as when the ends of the bone are united by a wide mass of cartilage, or by an actual false joint. The seton should be left for a long time, for four or five months, even to the consolidation of the bone (**Physick.**) Smearing the seton-thread with irritating ointment, for the purpose of strengthening its operation, may easily excite erysipelatous inflammation, abscesses, and constitutional irritation. The symptoms after sawing off

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(*a*) Von der Heilung des falschen Gelenkes, u. s. w.; in **Hufeland's** Journal, May, 1826.

(*b*) Hamburg Zeitzschrift.

(*c*) Archives Générales de Médecine, 1840, Octobre, p. 224.

the fractured ends may be very dangerous. Great inflammation, suppuration, and gangrene may occur, and these may even proceed to a fatal result.

In the thigh, the section is always effected with great difficulty and much danger; it has, however, been there performed with success (*a*): in limbs which have two bones the section has been considered impracticable; Fricke (*b*), however, and Cittadini (*c*) have performed it successfully on the fore-arm. Opinions as to the preference of the seton or of the section are very much divided; by both one as well as by the other mode of treatment, fortunate and unfortunate results have taken place; and equally celebrated Surgeons have held with the one and against the other practice (*d*).

[As far as my own observation and experience are concerned I cannot say that there is great encouragement for the performance of any operation for ununited or imperfectly united fracture, and I think a comparison of the results of the numerous cases which have been variously treated will confirm this opinion. The most favourable cases are those in which the ends of the bone are connected by cartilage or a cartilage-like substance, and in such I should certainly prefer the introduction of caustic potash. The least favourable cases are those in which the fractured ends have acquired a cartilaginous covering and are enclosed in a sort of synovial capsule, which indicates a total indisposition to the formation of callus; and therefore cutting off the ends, or scraping off their thin cartilaginous covering, is a very doubtful proceeding, as union will commonly not occur and the fractured ends be re-covered, as in Green's case. Perhaps, where the union is prevented by loose pieces between the ends of the broken bone, if these be removed, union may take place; but that this is very uncertain is proved by Mackmurdo's case.

The great difficulty to contend with, in determining on the performance of any operation with the reasonable hope of success, is the almost utter impossibility of distinguishing the real cause of the want of firm union, which can only be ascertained when the fractured part is exposed; and which very frequently disproves the diagnosis previously made. I think therefore that it is advisable in all cases of ununited fracture in which operations are performed that the Surgeon should fairly warn the patient of the great uncertainty of their result and leave him to determine for himself.—J. F. S.]

II.—OF HARE-LIP.

(*Labium Leporinum*, Lat.; *Hasenscharte*, Germ.; *Bec de Lièvre*, Fr.)

Heister, L., De Labio Leporino. Helmst., 1744.

Louis; in Mémoires de l'Académie de Chirurgie, vol. iv. p. 385.

Locher, De Operatione Labii Leporini. Jenæ, 1792.

Freter, De modis variis quibus Labium Leporinum curatur. Halæ, 1793.

Cellier de Clermont, De la Division Labiale. Paris, an xi.

Rieg, Abhandlung von der Hasenscharte. Frankfurt, 1803.

Desault, Œuvres Chirurgicales, vol. ii. p. 173.

Rau, J. D. L., Dissert. de Labio Leporino cum proëminentiis Maxillæ Superioris complicato. Berol., 1818.

Caspar, C. R., De Labio Leporino. An iv. Goetting, 1837. 4to.; with engraving.

Mettauer, John P., M.D., On Staphyloraphy; in American Journal of Medical Sciences, vol. xxi. 1837.

Demoncy, C., Dissert. de Labio Leporino. Mosquæ, 1839.

(*a*) Medico-Chirurg. Trans., vol. ii. p. 47.

(*b*) Oppenheim, above cited, p. 242.

(*c*) Ommodei, Annali universali de Medicina, Marzo, 1826, p. 411.

(*d*) Note the comparison of the cases of the one and other mode of treatment by Oppenheim.

Ballif, Apparat zur fixirung der falschen Gelenke. See Troschel, Dissert. de Pseudarthrosi. Berlin, 1826.

Sommé, On the Cure of a False Joint by the introduction of a silver loop and extension apparatus; in Med.-Chir. Trans., vol. xvi. p. 36.

722. The *hare-lip* is a division of the lip upon which the red edges are continued. It is always a vice of the original formation, though an old division of the lip may be consequent on external violence, if the edges of the wound have not united, but have skinned over. In the former case the edges of the cleft are smooth, and overspread with a delicate epidermis; in the latter irregular and callous. The hare-lip is always in the upper lip. The lip may be either partially or completely cleft, and is often accompanied with a cleft of the upper jaw and palate (*Wolf's Jaw*; *Palatum fissum*, Lat.; *Wolfsrachen*, Germ.)

The cleft is sometimes simple; frequently is there between its edges a larger or smaller middle piece. Bony processes often project into the cleft, or in adults the teeth protrude between the edges. Only when the hare-lip is connected with a cleft in the bone does it hinder children from sucking (1). In adults the speech, especially the pronunciation of the labial letters, is always indistinct in hare-lip.

[(1) This is commonly stated, but is not always so; the gap in the jaw and palate of course is a great obstacle to sucking, but it does not entirely prevent it, and the infant manages to acquire a compensation for a seeming want of which it was not aware.—J. F. S.]

723. Hare-lip, when an original vice, is an arrest of the development of the lip; as is wolf's jaw, of that of the jaw-bone. Both of them usually occur on the left side, whilst the right is naturally formed. When the cleft in the lip and jaw-bone is double, that is, running into each nostril, they are often separated at the underpart of the nasal partition by a projecting piece of bone which contains more or less incisive teeth (*Double Wolf's Jaw*, *doppelter Wolfsrachen*.) In several cases of hare-lip and cleft palate the olfactory nerves have been observed to be wanting (1).

[(1) I have been obliged to alter this paragraph very considerably, as the description given by CHELIUS is very obscure and not quite correct.—J. F. S.

PIGNÉ (*a*) has very properly stated, that "an acquired hare-lip may affect indefinitely all kinds of direction and position; but that the congenital form is always perpendicular to the free edge of the lip, and but *very rarely* met with in the mesial line."]

724. Hare-lip can only be *cured by operation*, which consists in removing the edges of the cleft with the *bistoury*, or with *scissors*, and uniting the fresh cleft. This is easy in proportion as the cleft is simple. If the palate be at the same time cleft it frequently closes after the cure of the cleft in the soft parts, but it may continue during the whole life. Although experience has shown, that the operation may be successful in very young children, it is, however, best to delay it till eight months (1). Only when wolf's jaw is connected with hare-lip, and the child cannot suck, may the operation be undertaken within the first six months (2). In children of two years the operation may be delayed till they have become intelligent. The previous drawing together the edges of the cleft with sticking-plaster or bandage, with a view to its more speedy union, is useless; but it may be advantageous in accustoming the child to the dressing. If there be a bony growth in the cleft it must, after the skin covering it has been raised, be removed with the nippers, and the bleeding having been stanched, the skin which has been preserved must be used for covering the *septum*. If the incisive teeth project, they must be extracted, if of the first set; but if of the second it must be attempted to give them their proper direction by continued pressure, and if this be not possible they also must be ex-

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(*a*) In his Translation of this Work.

tracted (3). Previous to the operation the child should be kept awake a long time (4).

[(1) **Lawrence** thinks "it is very desirable to remove the defect early on every account; in my opinion it is also advantageous as respects the success of the operation, that it should be performed at a comparative early period. I should say, then, that in the third, fourth, or fifth month after birth it should be performed, at all events, you should perform it at such a period that it will not interfere with the process of dentition. There is often a good deal of irritation going on in the neighbourhood of the part which is the seat of this defect at the time of teething, so that it is desirable you should accomplish the cure before dentition commences, or put it off till after the child has got its teeth; it is, however, in my opinion, desirable to perform it before. It so happens that I have had, at various times, under my care a great number of cases of this kind; I have invariably performed the operation at the time I have mentioned, and I have not, in any one instance, seen an unfavourable result from it considered as an operation, nor a failure of the ultimate object of the operation, that is, the closure of the preternatural fissure. It has sometimes been said that children are liable to convulsions at this time, and that a considerable loss of blood may act seriously on them, so that they may die from the mere effect of the operation. This has not occurred in any case that has come within my observation." (p. 819.)

Mütter says:—"If called a few days after birth, and the child is healthy, I operate for the hare-lip as soon as possible, believing as I do that the earlier the operation is performed the better. Much needless dread of convulsions, sloughings, fevers, &c., exists in the minds of some when they refer to operations of this kind upon very young children, but I have over and over again succeeded, without the occurrence of an untoward symptom, in infants of three, four, and five days old." (p. 25.)

(2) I do not think even eight months is sufficient age for the performance of this operation. Some Surgeons, as just mentioned, do not hesitate to perform it at six weeks or a month, or even at a shorter period after birth. But it is objectionable, because sometimes the child's crying more or less tears the new adhesions, and an ugly notch remains in the lip; or, what is still more important, it produces dangerous fainting from the loss of blood, or subsequent convulsion, which are only checked by the removal of the threads, and allowing the original gap to be reproduced. It should not therefore be lightly undertaken in very young children, as it exposes them to much danger. I would never perform it before two years old; but if the parents can be persuaded to wait till the child is six or eight, it is preferable, as the lip being thicker and larger, and the child being capable of understanding the advantage of keeping quiet for a few hours, the operation is more successful, and a better and more even lip is formed.

(3) Whether the teeth be of the first or second set, if they stick out much, there is little hope of bringing them into proper place by pressure, and it is therefore better to remove them, which should be done a day or two previous to the operation.

(4) As to keeping the child awake for some time before the operation, it is not matter of much consequence; for in general he will soon drop off to sleep.—J. F. S.]

725. The operation is to be performed in the following manner:—The child is to be held by one assistant, with his legs between his, and the child's hands within his. A second assistant presses the child's head against the breast of the former; and with his hands placed on each side beneath the jaw, at the same time he brings the skin of the cheeks somewhat forward, and compresses the facial arteries. The head of the child is always to be inclined a little forward (1). If the lip be united with the gum it must first be separated to a *sufficient extent* with a curved bistoury.

The Surgeon takes hold of the lower angle of the left edge of the cleft part with the finger and thumb of the left hand, or with a pair of forceps, and drawing it towards him, thrusts the blunt blade of a strong *pair of scissors* (2), curved at an obtuse angle on their outer edge, under the lip, and so high that the point reaches above the angle of the cleft. He then pushes the scissors a little upwards, and cuts off lengthways the whole red part of the cleft lip. Next, with the thumb and finger of the left hand, he takes hold of the lower corner of the right side of the cleft, and operates on it in the same manner, with his hands crossed. Both cuts must unite closely with each other above the angle of the cleft. If the cut be not perfected at once, it must be continued in the same direction, and without stretching too much the already divided part.

[(1) The position of the child's head is a matter of no slight importance; for if laid on the back, as often carelessly done, or if not so placed as to favour the streaming of the blood from the mouth, it will run back into the throat, and produce violent coughing and even choking.—J. F. S.

(2) LAWRENCE considers that "the scissors are the most convenient mode (of performing the operation for hare-lip) and that you will do it best with that kind which have knife edges; * * * they cut with great facility, without bruising the edges between the blades, and such scissors are the most convenient for paring off the edges of a hare-lip." (p. 819.)]

726. In using the *bistoury* the lip should be fixed upon a piece of wood introduced beneath it, or, still better, by BEINL's lip-holder (*a*), of which, the one blade of cork or wood placed beneath the lip, is to be carried so high that both blades rise above the angle of the cleft, and when closed leave about half a line of the naturally conditioned skin, together with the red edge of the cleft, uncovered. The bistoury is then thrust in a line above the angle of the cleft, and its edge being applied, beneath, is drawn down along the side of the upper blade, so that the whole edge of the cleft is cut off. The second edge is to be treated in like manner, the knife being introduced at the point where the first cut was commenced (1).

[(1) The bistoury is certainly preferable to scissors, which bruise the parts they divide. But I think our common mode of using it, is better than that recommended by CHELIUS; and a phimosis knife the most convenient and the only instrument required.

The Surgeon should grasp either corner of the cleft lip, which he fancies most convenient, with the finger and thumb of his opposite hand, and then passing the point of the knife behind the lip, he thrusts it through about a line above the angle of the cleft, draws it down till it has cut through the red part of the lip, taking care to cut off the whole piece which, entering into the cleft, rises above the proper level of the lip, for unless this be attended to, an ugly notch remains after the union of the wound. The other edge is afterwards to be pared in like manner. There need be no fear of freely cutting away the lip, as the edges always readily come together, and if they seem to need any dragging at the upper part, to effect this it is better to divide the neighbouring membrane of the mouth, to prevent such drag.—J. F. S.]

727. The bleeding is generally inconsiderable, and stanched by the close junction of the fresh-made edges, which is best effected by the *twisted suture*. For this purpose gold or silver needles are used, with steel points, which can be removed (1). The left edge of the lip is to be held with the thumb and finger of the left hand, and the needle thrust vertically through near the red edge of the lip, and from three to five lines distant from the edge of the wound, to the lining membrane; it is then to be brought horizontal, so that by pressing, its point appears near the edge of the lip in the surface of the wound. The other edge of the wound is now to be brought with the fingers of the left hand to that already pierced, and the needle introduced in the same direction and made to pass through externally. The point of the needle is now to be removed, a thread applied around it, and its ends drawn down by an assistant. At two or three lines' distance from the former a second needle is to be introduced, whilst with the thumb and finger of the left hand its point is pressed against the right edge of the wound. If the cleft be large, the employment of a third or fourth needle may be necessary. A stout thread is then to be twisted around each needle in form of ∞, first upon the upper pin,

(*a*) Beobachtungen der Chirurgischen Academie zu Wien, 1801, vol. i. pl. ix.

and then on the others, and to be sufficiently drawn till the edges of the wound are brought into close contact. The ends of the thread are to be tied in a slip knot; and care must be taken that the threads should regularly and closely cover every part of the wound. Beneath the ends of the needles pieces of sticking plaster should be put, for the purpose of preventing their digging into the skin. The union is to be supported by strips of sticking plaster with their ends cleft, their middle being placed on the nape of the neck, and the cleft ends carried beneath the ears over the cheeks, which are to be pressed forwards, continued in the interspaces of the needles, crossed and fastened upon the opposite sides.

Dieffenbach, instead of the common pins for twisting the threads upon, employs the most delicate Karlsbad insect-needles, which he separately envelops in thread, and cuts off the two ends of the needle with scissors (2).

As regards the result of the operation, it is nearly the same whether the edge of the cleft be removed with the bistoury or with scissors. In thick, puffy, and irregular edge, the bistoury is always preferable. The union of the cleft by the twisted suture and sticking plaster is most preferable, as the interrupted sutures, recommended by some, do not produce so close union, and the threads easily tear out. The uniting bandages and dressings of Richter, Stückelberg, and others, are easily displaced. Mayor (a) pierces the left edge of the wound near its free end with a needle, which he introduces at a right angle from within outwards, drawing with it a double thread, at the end of which a ball of cotton is attached; by its pressure the edges of the wound are united, and, by tying together the ends of the threads upon a ball of wool put between them, the union is supported probably as well as in the seam suture.

[(1) "It has usually been the practice," says Lawrence, "to employ two hare-lip pins, (consisting of a hollow silver cylinder with a steel point,) and to put one just at the point where the red part of the lip joins the external integuments, and another near the upper angle of the wound; but in performing the operation on the young subject at the age I have mentioned, and I have always performed it thus early, I have invariably found it sufficient to use a single hare-lip pin, introducing it at the lower part of the fissure, near the red portion of the lip, and to unite the wound at the upper angle with a simple suture. * * * Having introduced the pin, I take out with the forceps the steel point, the silver part only being left in its situation. * * * Then having secured the pin with two or three turns of the silk, you can put in the simple suture. * * * You do not put anything further over the wound, there is nothing wanted, in fact; you leave the wound, and find that you can remove the pin and cut out the simple ligature placed above it, about the fifth or sixth day, when you will usually find the fissure completely united." (pp. 819, 20.)

(2) The thin insect-pins recommended by Dieffenbach are much the best kind of pin for this operation; and the thinner they are, if they will only bear the necessary pressure for their introduction, the better, as they leave a proportionally smaller scar. I generally use three pins. The application of strips of sticking plaster is as unnecessary as it is irksome.—J. F. S.]

728. After the operation the child is to be laid a little on one side, and attention paid to the continuance of the bleeding (1); he should be soothed as much as possible, and the food should be given only at the corner of the mouth. If he cry much, some *syrupus opiatus* should be given. The dressings must be cleaned daily with luke-warm water from the mucus flowing from the nose, and the needles smeared with oil. On the fourth day, after having removed the plaster and cleansed and oiled the needles, they are to be removed, the upper first, and afterwards the lower, during which the lip is to be held together with the fingers of the left hand, sticking plaster must be applied till the wound is perfectly consolidated (2).

[(1) Bleeding after the edges of the wound have been applied and fixed with the pins and threads is of very rare occurrence; indeed I have never known it happen. As no plaster should be used, scabs very quickly form on the wound and about the threads, which are best left alone. If there be any oozing, or if drivelling from the nose, it may be gently mopped with a piece of soft linen, but as little as possible.

(a) Nouveau Point de suture pour l'opération du Bec de lièvre; in Gazette Médicale de Paris.

(2) The time recommended by **Chelius** for leaving the pins in is too long; thirty or forty hours at the utmost is amply sufficient, and sometimes even less; for so soon as pus is observed about the needles it is proper they should be withdrawn, as they then cease to be of use, and only cause irritation; and this occurs more or less quickly according to the powers of the constitution.

In removing the pins it is best to draw them gently through each coil of thread with a pair of stout dressing forceps, supporting the wound at the same time with the finger and thumb; and after their withdrawal the thread should be gently picked off with the finger-nail or with a probe, The upper two pins and threads should be first removed, and a long strip of plaster carried across the lip from ear to ear, which done, the lower pin and thread are to be taken away. The plaster may be reapplied two or three times daily or every second day, but its use is rather precautionary than necessary.—J. F. S.]

729. If much inflammation of the wound occur after the operation, the threads, if too tightly drawn, must be loosened, and lead wash applied. Cramps and convulsions require narcotic remedies. If the needles tear out, the union must be again restored by the twisted or interrupted suture (1); or if the separation of the edges of the cleft be partial, the union must be assisted by the continued application of sticking plaster. This is, indeed, best in the first instance, because the needles introduced through the *inflamed* edges of the wound again tear out. The needles are most certainly prevented tearing out if they are passed in and out from the edge of the wound, and not left in more than three days.

Van Onzenort's advice is to pass the needle on each side of the wound through pieces of leather, to prevent the tearing away.

[(1) If the needles tear out, an accident which I have never known to occur, I think it would not be advisable to reintroduce them, as there could be no more probability of union occurring than in a torn wound, and their presence would therefore only increase the irritation. It would therefore be best to leave the parts alone, and to repeat the operation at a future opportunity.—J. F. S.]

730. In double hare-lip, when the middle piece is sound and large, the edges on both its sides must be pared and the needle passed through the edges of both cleft and middle piece; but if it be small and crumpled it must be removed. If the cleft pass into the nostril, the lip must be separated from the gum equally high, the upper part of the cleft freely pared, and the upper needle introduced as high as possible (*a*).

731. Nothing has been done towards the union of the cleft in the hard palate. It has been recommended to make continued pressure on both upper jaw-bones with a stirrup-like apparatus (1). If nature do not close these clefts, the inconvenience may be diminished (*b*) by a sponge introduced into it and fastened upon a silver or leather plate.

[(1) **Mütter**, who advocates early operating on cases of hare-lip and cleft palate mentions, among the advantages of so doing, that " the influence exerted by the pressure of the cheeks and lips upon the maxillary bones is sometimes sufficient of itself to cause an entire closure of the fissure in the hard palate. We have thus, when the patient grows up, only the cleft of the soft palate to contend with." * * * After the lip has entirely healed, I have derived much advantage from causing the nurse to introduce her finger and thumb as far as possible into the mouth between the cheeks and alveolar processes, and make lateral pressure upon the latter several times a day. I have also resorted, in very bad cases, to a small silver clamp, composed of two flat blades and a regulating screw. The blades being properly adjusted, one upon each side, the screw is gently turned so as to produce the requisite degree of pressure. If called to a child a few years old, affected with hare-lip and a cleft palate, we have no time to lose, and should operate on the lip at once. Even in these cases I have seen quite a wide cleft closed by the action of the cheeks aided by the silver clamp." (p. 26.)

(*a*) **Froriep**'s chirurgische Kupertafeln, pl. ccxxv. ccxxvi.

(*a*) **Dieffenbach**'s proposition; in **Hecker**'s literarische Annalen, July, 1827.

(2) As to the use of obturators, I think Mütter's observations are well worthy attention. "It is highly improper in these, as well as in all other cases of the defect in young children, to use an *obturator fastened by means of a sponge*, as the foreign body effectually prevents the closure of the opening. An artificial palate, fastened to the teeth or gums, by preventing the passage of food into the nostrils, will, on the other hand, prove exceedingly useful, as well as a source of decided comfort to the patient." (p. 27.)

Operation for Cleft in the Hard Palate.

Mettauer has proposed and practised successfully, as has also Mütter, a mode of *Staphyloplasty* by granulation, as the latter calls it, in cases "where there is a separation of the margins (of the fissure in the hard palate) to an extent which will not allow them to be approximated. * * * The first operation contrived by us in a case of this description, consisted of a series of incisions more or less extensive, formed exterior to the margins of the cleft and parallel with them, extending from the faucial to the nasal surface on both sides. These incisions being designed as granulating surfaces, were not allowed to re-unite by the first intention, but kept apart by interposing between them small portions of buckskin or soft sponge, there to remain until suppuration should be well established and then to be removed. Incising from the supporting portions of the lips of the cleft a belt more or less wide and supported at each extremity by the natural continuity of the textures through which they may be nourished by blood. enables us to create an extensive surface for eliciting and rearing of granulations without the least hazard or danger of disorganizing the parts separated or their respective lips. In this condition they take on inflammation, which speedily terminates in suppuration; and granulations soon sprouting out from these newly created surfaces, fill up the incisions by which they are separated, and thus widen the lips to a greater or less extent. The first incisions are to be most extensive; and as the lips are expanded they should be less so, or the cicatrices may ulcerate or become disorganized and slough. The newly-formed parts cannot be safely incised until perfectly organized. It would be most safe to perform the succeeding sections exterior to the cicatrices and in the original textures, as they granulate most readily and freely, and are not liable to ulcerate or slough. Should the parts be deficient in length, the method which we have been describing may be employed in a transverse direction guided by the views just submitted, but not to divide the *tensor palati* muscle. * * * Cures by this method must necessarily be tedious, and the time required for their accomplishment more or less protracted, as the cases are distinguished by fissures of greater or less extent, or lips thin or the reverse." He therefore proposes another more expeditious operation, which "consists in making the sections of the lips of the cleft oblique instead of perpendicular, as in the preceding operation; and as it were to divide or split them, so as to separate the nasal from the faucial portions of the lips. This method unites the advantages of the flap and granulating process. * * * The Surgeon commences the operation by denuding the margins of the lips of the fissure, as already described. As soon as the bleeding ceases, an incision is to be commenced in one of the lips, a little exterior to its margin and a few lines anterior to its uvulal verge. The marginal incision on the faucial surface should commence nearly a line and a half or two lines from the margin of the lip. At this point, the knife is to be inserted and directed in such a manner as to cut the lip obliquely from a line continued from the point of its insertion parallel with the margin of the lip to the angle, to another line passing in or near the base of it on its nasal surface, thus forming the section in the diagonal between these points of the faucial and nasal surfaces of the lips of the cleft. * * * It will always be found most convenient to dissect from the *uvula* upwards, as by that means the blood, which otherwise might essentially perplex and embarrass that step, will, in some degree, be avoided. These incisions should always extend a few lines above the angle, and must never be carried nearer than two or three to the uvulal margin of the lip of the cleft." The section of the opposite lip is to be performed in the same way, as soon as the bleeding from the first has ceased. "The ligatures must be now introduced, and with as little delay as possible, or the lips may become so tender as to render their application exceedingly painful; and should much time be delayed, even dangerous. For this purpose the canulated needle-porte, armed as already directed, should be employed. * * * The sutures are in these cases to be inserted a little interior to the margins of the labial cuts on their faucial surface, so as to permit a belt of the natural covering of each lip of the cleft to be interposed between the denuded margins and the incisions, and embraced by the noose of each of the sutures. * * * Under no circumstances will it be prudent to begin the insertion of the sutures of the lips elsewhere than at the angle of the cleft. Although we have described this mode of operating for cleft palate, as if executed upon the lips of the fissure their whole length, it is not to be inferred that we advise the measure in every case. On the contrary, this will seldom be safe, especially when the fissure is very extensive. The sections may be formed as we have described them, the whole length of the lips of the cleft, but it will not be safe to attempt to insert ligatures, at the first operation, to more than a third or half of the margins thus incised. * * * After the margins of the denuded and incised lips have been approximated and firmly united at the median line of their contact, and sufficient time has been allowed for the subsidence of the several traumatic, irritative and inflammatory movements, as well as for the consolidation of the union of the parts involved in the operation, the remainder of the cleft may be closed in the same manner, only extending the diagonal section now quite through the uvulal margins, which, after they are approximated in the line of the fissure by the suture, but not confined in close contact, may themselves have sutures applied on their posterior margins, merely to prevent the displacement of the cut edges, and to keep the surfaces in contact as far as they are opposed to or overlap each other. * * * This operation will be equally applicable when the fissure extends entirely through the palatine and alveolar processes of the superior maxillary bone, with or without a division of the lip, and when the margins of the cleft, as is usual in such cases, are permanently separated. But when the lip is involved and the case complicated with hare-lip, staphyloraphy as well as the operation for this last infirmity, will be demanded. In such a complication the long cleft must be first connected, as the parts then will be more easy of access to the operator, and the operation more easily executed while the division of the lip remains open; after the long cleft is closed, the operation for hare-lip may be performed at once, or after the cure of the fissure is perfected. * * * As soon as the union between the lips has become firm the sutures may be cut away; generally on the sixth or seventh day, the first nearest the angle may be removed; and on alternate days, as shall be found safe, the remainder may be removed." (p. 325–31.)

In a case of chronic mercurial disease in which there was an oval opening three-fourths of an inch in length by nearly half an inch in breadth, on the right side of the roof of the mouth, through which the finger might be readily passed into the nostril of the same side, but in which the *velum palati* was barely involved, MÜTTER successfully practised WARREN's "operation of sliding the flap modified so as to embrace the operation by granulation of METTAUER." * * * With a small thin convex-edged bistoury he made a crescentic incision through the mucous membrane, and down, in fact, to the bone, commencing the incision nearly opposite the superior extremity of the opening, and continuing it until it reached a point nearly opposite its inferior. A strip of mucous membrane, about three lines and a half in breadth, was thus separated, except at its extremities, from the adjacent parts. A similar incision was then made on the opposite side. The lips of the little wound were then detached from the subjacent bone to the extent of one line on each side, and then folded, as it were, upon themselves, thus leaving a gutter, into which he inserted a small cylinder of soft buckskin. * * * Inflammation followed by suppuration speedily supervened, and on the removal of the cylinder, seventy-two hours after its introduction, a fine crop of healthy granulations was discovered at the bottom of the wound; these rapidly increased in size, and soon filled up the space between the lips of the incisions, rendering the introduction of any foreign body for the accomplishment of this object needless. In six days after the first operation, and when the granulations were in full vigour, I performed the second series of incisions, which were carried between the extremities of the other two, and treated in precisely the same manner. In six days from the execution of this second operation I found the opening in the palate surrounded by a strip of granulations, and in a proper condition for the last and by far the most difficult step in the whole attempt, the detachment and approximation of the flaps. * * * I commenced by detaching the mucous membrane all around, dissecting from the margins out to the granulations, which being very yielding, allowed me without difficulty to bring the flaps together at or near the centre of the opening. To accomplish this a pair of small forceps was employed, and while the flap was held tense by an assistant, I passed the ligature first through the flap on the left side, at its centre and about a line from its edge, and then allowing that to escape from the forceps, the opposite one was made tense and the ligature passed through it at a point directly opposite the little wound in the other; the ligature was then tied, and the flap above, or that next the anterior portion of the mouth brought into the concavity formed by the approximation of the two lateral flaps, and attached by a ligature on each side. The lower was next brought to its proper position, and there held by similar stitches. The opening in the palate was thus completely covered in. The usual after-treatment was pursued, and in three weeks from the date of the last operation my patient was perfectly relieved of every vestige of his deformity. The ligatures were cut away on the fourth, fifth, and sixth day, and nothing of consequence occurred during the period of confinement." (pp. 21, 2.)

III.—OF THE CLEFT IN THE SOFT PALATE.

(*Fissura Palati Mollis,* Lat.; *Spalte im weichen Gaumen,* Germ.; *Division du Voile du Palais,* Fr.)

Graëfe, Die Gaumen-Naht, ein neuentdecktes Mittel gegen angeborne Fehler der Sprache; in Journ. für Chirurg. und Aungenheilk., vol. i. p. 1, and p. 556.

Stephenson, Dissert. de Velosynthesi. Edinb., 1820.

Doniges, De variis uranoraphes methodis Aphorismi. Berol., 1824. 8vo.

Ebel, Beiträge zur Gaumen-Naht; in v. **Graëfe** and v. **Walther's** Journal, vol. vi. part i. p. 79.

Wernecke, Ueber die Gaumen-Naht; ib., p. 102.

Roux, Mémoire sur la Staphyloraphie, ou Suture du Voile du Palais. Paris, 1825. 8vo.

Dieffenbach, Vergleichende anatomische Untersuchungen über den Gaumen-Segel; in **Hecker's** literarischen Annalen.—Beiträge zur Gaumen-Naht; ib., Febr., 1826, p. 145; July, 1827, p. 343.

Schwerdt, F., Die Gaumen-Naht; a description of all the various methods and the instruments known to have been used in, up to the present time; with a preface by v. **Graëfe** and four copper-plates. Berlin, 1829. 4to.

Velpeau, Nouveaux Elémens de Médecine Opératoire. Paris, 1832. 8vo.

Hosack, A., Memoir of Staphyloraphy; with cases and description of the instruments requisite for the operation. New York, 1833.

Mütter, Thomas D., M.D., A Report on the Operations for Fissures of the Palatine Vault. Philadelphia, 1843. 8vo.

• 732. The cleft in the soft palate occurs, not very unfrequently, as an original vicious formation, confined often merely to the *uvula,* which is then bifid, or including the whole soft palate. It is often also connected with a cleft of larger or smaller size in the hard palate, and also with hare-lip. The consequences of this misformation in early life, are great difficulty or complete incapability of sucking, especially in the horizontal posture. The bringing up of such children is, therefore, often accompanied with the greatest difficulty, suckling being only possible when the child is held quite upright, and when the flow of the milk is assisted by pressure on the breast, or the food is in this position allowed to flow into the mouth, in very small quantities at a time. The consequences of this misformation are manifested at a later period of life, by its interference with the speech, which is more or less indistinct and unpleasant. The person so affected cannot blow out air from the mouth with any force; and fluids cannot be swallowed in the horizontal position without great difficulty.

733. Artificial palates, such as are employed in cleft of the hard palate, are ordinarily useless in this ailment; because they always produce the same interference in the articulation of tones; but very carefully made elastic obturators may in some degree lessen the difficulty (*a*); their use, therefore, may be permitted in those cases in which the union of the cleft does not succeed, or is especially impracticable (*b*). The cure can be

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(*a*) **Graëfe's** artificial palate-curtain; in his and **Walther's** Journal, vol. xii. p. 655.

Snell, J., Observations on the history, use, and construction of Obturators or Artificial Palates, illustrated by cases of recent improvement. London. Second Edition, 1828.

(*b*) For how little benefit is obtained from them see **Dieffenbach** in **Rust's** Magazin, vol. xxix. p. 491.

effected only by the union of the cleft after previous paring of the edges. This operation, (*Gaumen-Naht*, Germ.; *Staphyloraphy*, *Kyanoraphy*, *Uranoraphy*, *Uraniskoraphy*,) first proposed by GRAËFE, and performed in the year 1816, is in itself of no great importance, but, on account of the difficulties in its performance, is one of the most delicate operations. The more full, and the less apart the edges of the cleft are, and the less they are stretched, the more complete is usually the result of the operation. If there be at the same time a cleft in the hard palate, the perfect union of the cleft in the soft palate is but rarely effected; most commonly the operation is quite unsatisfactory. The operation should not be performed on children, but only in adults. Staphyloraphy may be also employed in other diseased conditions of the soft palate than congenital clefts; as, for instance, in wounds (*a*), and in the division produced by syphilitic ulcers and the like.

EBEL's advice is to prepare the patient for this operation by frequent dabbings, and brushings of the palate curtain, by pressing down the tongue and the like for the purpose of accustoming these parts to irritation. GRAËFE's proposition is to excite active inflammation and superficial suppuration, by frequently touching with concentrated muriatic or sulphuric acid, the parts lying near the cleft in the palate curtain, in order to render them fitter for union, by altering their tissue if it be too open, too soft, too full of the juices, too muco-membranous (*d*).

734. The operation of Staphyloraphy, for the performance of which so many different, and some extremely complicated and unsuitable, modes have been proposed, is most simply and suitably conducted in the following way:—The patient being placed opposite a good light, the mouth wide open, and the tongue well depressed by the patient's own efforts; or the mouth kept open with a piece of cork introduced between the hinder grinding teeth, and the tongue depressed by an assistant with a simple spatula, half a line of the lower part of the left edge of the cleft is to be caught hold of with a pair of sufficiently long hooked forceps, gently drawn out, and a lancet-shaped cataract knife is to be thrust near the forceps through the edge of the cleft. The knife is then to be sawed from below upwards, and a strip as wide as a straw separated up to the angle of the cleft. And, lastly, the little part where the forceps have been applied is to be cut off from above downwards. In the same manner the opposite side is to be treated, and especial care should be taken that, at the angle of the cleft, both cuts are very close, and joining at an acute angle, and that the removal of the edges be everywhere equal. The patient is then to be left quite quiet, and may frequently gargle with cold water, by which the slight bleeding is easily stopped, and the viscid mucus got rid of.

[The operation of staphyloraphy appears to have been first performed by LE MONNIER, and is thus mentioned by ROBERT (*c*):—" A child had the palate cleft from the *velum* to the incisive teeth. M. LE MONNIER, a very clever dentist, attempted with success to *re-unite the two edges of the cleft*, first making *several points of suture* to hold them together, and then *refreshing them* with a cutting instrument. Inflammation ensued, terminated in suppuration, and was followed by union of the two lips of the artificial wound. The child was perfectly cured." Upon which VELPEAU observes:—" A child, a cleft, the suture, the refreshing, the cure, everything, in spite of the somewhat vague expressions of ROBERT, scarcely permits us to doubt that this dentist truly had recourse to staphyloraphy, and not to the suture of a simple perforation of the palatine vault." He also mentions, that "in 1813 experiments upon the dead body were made by COLOMBE, and that he was desirous of repeating them on a patient in 1815, who, however, refused." (p. 573.)]

(*a*) FERIER; in Révue Méd., 1823, July, p. 245.

(*b*) SCHWERDT, above cited, vol. ix.

(*c*) Mémoires sur différents objets de Médecine. Paris, 1764.

For the purpose of keeping the mouth open and pressing down the tongue, artificial means, as the introduction of cork between the back teeth, **Suchet**'s katagoglos (*a*), as well as the introduction of a blunt hook at the corner of the mouth, are superfluous; and the depression of the tongue with a spatula is so much the more dangerous, as thereby choking is only more provoked. The fixed purpose of the patient is fully sufficient. It must, however, be remarked, that during the operation the patient is to be often allowed rest and the mouth rinsed with cold water, partly to stanch the bleeding, and partly for the removal of the mucus hanging about. The refreshing of the edges of the cleft from below upwards in the way proposed, is more certain than from above downwards, because the flowing of the blood does not interfere with the direction of the knife.

According to **Graëfe**'s original proposal, the edges of the cleft should be brought into a suitable condition for union, by removal with a chisel-like instrument, furnished with a counter-hold, or by touching them with muriatic, or sulphuric acid, caustic potash, tincture of cantharides, and the like. Subsequently, when this operation had been performed by others in a more simple manner, **Graëfe** also employed for the removal of the edge of the cleft, a pair of curved forceps and a narrow knife, which he carried from above downwards. **Roux**, who commenced with the introduction of the threads, then laid hold of the lower part of one edge of the cleft with a pair of forceps, drew it out, and cut it off with a straight button-ended bistoury, sawing it from below upwards. **Ebel** (*b*) also and **Krimer** (*c*) use a pair of forceps and a simple knife, directing it from below upwards. **Dieffenbach** (*d*) freshens the edges of the cleft with a bistoury, laying hold of the edge of the cleft with a hook, and cuts off a straw's breadth with the bistoury, directed from below upwards. **Bérard** (*e*) makes his incision from below upwards. **Alcock** (*f*) used the fine scissors, which **Roux** also partially employed, in a bent form, in his later operations.

735. For the purpose of uniting the raw edges, a thread is to be used, on which two straight needles are threaded; each needle is to be held with a needle-holder, and thrust through, the edge of the cleft being fixed with a pair of forceps, from behind forward, at three and a half to four lines distance from the edge; the point of the needle is now to be taken hold of with the forceps which had hitherto held the edge of the cleft, and drawn out together with the thread. The other edge of the cleft is to be similarly treated. The number of stitches which are thus to be introduced, differs according to the size of the cleft. If the *uvula* be completely cleft, then from three to four stitches are necessary, and the upper must always be first put in. After the patient has been allowed a little rest, and cleared his mouth with water from blood and mucus, the threads must be tied together by means of the extended forefinger against the wound, first with a surgical, and afterwards with a common knot, and cut off close to the knots.

Various modes of treatment have been recommended for bringing the cleft together. **Graëfe**'s hook-like needles, and the threading of the two ends of the suture into the lateral openings of a canula placed on the palate, and when the threads have been sufficiently tightened, is closed by means of a screw. Subsequently he employed nearly straight needles, and tied the threads (which were black and soaked with oil) in a surgical and afterwards in a simple knot (*g*). **Roux** used needles of a small curve and a needle-holder, and tied the threads together in two simple knots, in which the first is held with forceps till the second is looped, so that it may not meanwhile give way. **Ebel** (*h*) employs for the sewing, short, straight, double-edged needles, and a needle. **Doniges** proposes a long needle, like an aneurismal needle, with a very sudden curve, a sharp point having an eye immediately behind it and the stem fixed in a handle bent down, for convenience, like the handle of a gorget. The needle threaded, is passed from behind through either edge of the cleft, and the end of the thread on the inside of the

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(*a*) Journal complément. du Dictionnaire des Sciences Médicales, November, 1822.

(*b*) Above cited, p. 86.

(*c*) In **Graëfe** und **Walther**'s Journal, vol. x. p. 622.

(*d*) Above cited, Feb., 1826.

(*e*) In **Schmidt**'s Jahrbücher, vol. iv. pt. iii.

(*f*) Transactions of Apothecaries and Surgeon-Apothecaries of England and Wales. Lond., 1822.

(*g*) **Schwerdt**, above cited, and in **Graëfe**'s Journal, vol. x. p. 371.

(*h*) Above cited.

needle curve, being caught with a hook or forceps, is drawn forwards and completely through; the needle itself still unthreaded, is then drawn back, its point carried behind the other edge, and having been thrust through, the thread on the outside of the needle curve is drawn forwards out of the needle-eye, which being thus set at liberty the needle is withdrawn entirely, the threads passed through each other and tied, by thrusting down between them a little plate six lines long, with a notch at each end for the threads to run in, two lines broad, and fixed on a stem four inches long, with a handle. WARREN (*a*) proceeded in a similar manner, not only in the case he describes, but also in another on which he operated some years previously. "The principal difficulty he met with in this operation was in disentangling the ligature from the hook after it had perforated the palate, and he therefore proposed a curved needle with a movable point, which after having been passed through the soft palate, can be separated from the stem, unthreaded, and having been refixed and rethreaded with the hinder end of the thread, is passed through the other edge of the palate, and separated from the stem as before. As to the objections to this treatment, see SCHMIDT (*b*). WERNECKE used a needle with an eye in front, and a whalebone handle. LESENBERG's (*c*) needle is similar to that of DONIGES, but its point can be covered with a guard. KRIMER (*d*) also uses a similar needle, which can be closed.

The instruments for drawing the knot have also been varied by the above-mentioned practitioners. WERNECKE carried the knot up to the palate with two small grooved probes, and cuts off the ends of the thread. EBEL used small tubes, and DONIGES the special knot-tier, already mentioned.

DIEFFENBACH by means of a nearly straight needle, into the hinder hollow part of which a leaden thread has been introduced, unites the cleft by drawing the wire together; cuts it off a few lines distant from the soft palate, and turns the twisted ends upwards, so as not to irritate the root of the tongue. The lead wire allows loosening and much tightening. DIEFFENBACH also proposes to effect the union with a pair of peculiar forceps.

HRUBY's palate-holder, is similar to BEINL's lip-holder (*e*).

SCHWERDT's cleft needle for the introduction of the thread (*f*).

BÉRARD (*h*) thrusts in the needle from before backwards.—SMITH's needle (*g*) is long lance-shaped, and furnished with a notch for the reception of the ligature. [But MÜTTER objects to it, "first, as being mounted on a straight handle, which renders it more difficult to introduce its point at the proper places; and secondly, the difficulty of disengaging the thread, which may be drawn back along with the needle in the attempts of the Surgeon to disengage the latter from the margin of the palate." (p. 9.)]

ALCOCK (*i*) operated at intervals, so that he made raw, and united only one part of the cleft; in one case he only effected perfect union after five operations: in the first four he used the interrupted, and in the last the twisted suture.

HARTIG (*k*) effects the union by means of a palate-cramp (*fibula seu retinaculum palati.*)

[LISTON (*l*) introduces a double ligature on a curved needle fixed in a handle, through the front of the palate curtain, "the noose of which is caught by a blunt hook and pulled out into the mouth whilst the instrument is withdrawn. A second and smaller ligature is carried through opposite to this, and by means of this second thread the first and double one is brought through" (p. 503) MÜTTER uses a much curved "needle half an inch in length and mounted on a cylindrical neck, a portion of which is held in the grasp of the porte, (SCHWERDT's,) and the other part, made rough, is intended to be grasped by the forceps of an assistant. The cutting edge of the needle being wider than the diameter of its neck, will make an opening large enough for the easy transmission of the ligature. The forceps too may be improved, by causing them to close with a spring instead of a catch." (p. 9.)]

FERGUSSON, of King's College Hospital, has proposed a new mode of staphyloraphy, and has successfully treated two cases by it. "The principle of this new proposal is to divide those muscles of the palate which have the effect of drawing the flaps from each other, and widening the gap between them when they contract; so that the stretched

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(*a*) American Jour. of Med. Sciences, 1828. Nov.

(*b*) VON GRAËFE and VON WALTHER's Journal, vol. v. pt. ii. p. 338.

(*c*) Dissert. de Staphyloraphia quædam. Rostochii, 1827.

(*d*) VON GRAËFE and VON WALTHER's Journal, vol. x. p. 622.

(*e*) In VON GRAËFE and VON WALTHER's Journal, vol. ix. p. 323, pl. iii. f. 2.

(*f*) Above cited, pl. iv. f. 7

(*g*) Above cited.

(*h*) North American Archives of Medical and Chirurgical Science, October, 1834.

(*i*) Above cited.

(*k*) Beschreibung eines neuen Apparates zur. Vereinizung des gespaltenen Gaumens ohne Naht. Braunschweig, 1841.

(*l*) Practical Surgery, London. 1837. 8vo.

velum may be in a state of repose, and the pared edges may not be pulled asunder by any convulsive action of the parts during the process of union. In other words, he advises, as an important accessory to the operation of staphyloraphy the division of the *levator palati* and *palato-pharyngeus* muscles, and, if requisite, the *palato-glossus* (*a*).

736. If in very large cleft, the closure be difficult and only to be effected with great stretching, in consequence of which severe inflammation and tearing of the sutures are to be dreaded, the satisfactory result of stitching the palate is rendered most certain, according to **Dieffenbach** (*b*), by making an incision with a bistoury down to the bone on each side of the closed cleft of the palate, and half an inch distant from the lower edge of its arch. This immediately produces relief from all tension, the united edges hang loosely in the middle, unite together and the threads neither cut in nor through ; the patient breathes freely through the holes, as otherwise the great swelling of the palate renders breathing very difficult. In the previous tension of the palate there is also great increase of substance as the lateral openings are closed by granulation in from ten to fourteen days. When at the same time there is a cleft in the hard palate and considerable separation of the edges of the cleft, it may be necessary for effecting the union to separate the soft palate, to some extent from the hard palate, by two horizontal incisions.

Bonfils (*c*), after paring the edges, separates a V-shaped piece of skin from the palate, corresponding to the cleft, and unites it by the interrupted suture.

In a case in which the cleft of the soft was connected with that of the hard palate, and the distance of the edges was great, for the purpose of bringing them into contact, **Roux**, after putting in the stitches, and paring the edges, made two horizontal cuts, which divides the soft from the hard palate, and extended from the edge of the cleft somewhat above the perpendicular of the ligatures on both sides. The edges of the cleft may in this way be easily united.

In one case, in which with a cleft of the soft palate there was also a very considerable wolf's jaw, and the union of the soft palate thereby rendered impossible, **Krimer** (*d*) made on both sides two longitudinal incisions, four lines distant from the edge of the cleft, which joined together at an obtuse angle in front, and terminated behind at the still projecting portion of the soft palate ; the soft parts were then divided by these cuts towards the edge of the palate, that a pair of wedge-like flaps were formed with their bases behind. After the bleeding had been stanched with sage-water and alum, the flaps were turned inwards, so that their palatine surface was level with the floor of the nostrils, and the sewing together of the palate was then effected with the needle-holder in the ordinary way. **Dieffenbach** (*e*) proceeds more simply ; after closing the cleft in the soft palate, he separates the soft parts on the hard palate, shaves the bone, and draws together the edges with lead wire.

[**Mütter** mentions that **Warren** of Boston, U. S., had succeeded in closing a deficiency in the upper part of a palatine cleft, or that portion which extended into the hard palate, by detaching the mucous membrane, and sliding it from each side to the median line, uniting the flaps by two or three sutures." (p. 20.)]

737. After the operation, the patient may neither speak, nor take food, nor swallow his spittle, but must have it removed from his lips with a cloth, or carefully allowed to flow into a vessel, and everything must be avoided which may excite coughing, sneezing, or laughing. At the end of the third the upper, and at the end of the fourth day the lower stitch may be removed, the knots being held with a pair of forceps and the thread cut by its side with a pair of scissors and drawn out in the contrary direction. Nourishing broths may be taken at first in small quantity and with great caution, and when the union has become firm, more solid food may be allowed.

(*a*) Medical Gazette, N. S., vol. i. p. 389. 1844–45.
(*b*) In **Rust's** Magazin, vol. xxix. p. 491.
(*c*) Journal de Médecine, 1830, December, p. 297.
(*d*) von **Graefe** und von **Walther's** Journal, vol. x. p. 625.
(*e*) **Rust's** Magazin, vol. xxx. p. 288.

According to **Graëfe**, if the spittle be collected in the throat in quantity, we should attempt its removal by injecting, or by brushing off with a brush made with charpie or linen. A solution of from one to two grains of extract of belladonna may be at once given in a little water, by which the patient is much relieved. On the first days also he permits strong wine, with yolk of egg, given with a spoon, and nourishing clysters. The living activity in the edge of the wound may be increased by pencilling with muriatic acid, naphtha, equal parts of tincture of euphorbium, cantharides, and myrrh, or in torpid persons, with tincture of cayenne pepper or capsicum. The stitches should only be removed when they entirely or partially fall out of themselves. **Dieffenbach** also says that the patient may take fluid food without fear.

[Although the operation of staphyloraphy is generally unattended with danger, yet, in a few instances it has been fatal from the inflammation spreading along the windpipe to the lungs, as happened in the case of an English nobleman's daughter, who was operated on by **Roux**; the only one, of sixty cases on which he operated, which he lost. **Bérard** (*a*) also mentions that he lost one case from *pneumonia*, originating in the same cause; and that, in another instance, the face was attacked with erysipelas, from which, however, the patient recovered.]

738. If the union be only partially effected, the mouth may be washed gently with red wine, and the open parts pencilled with honey of roses, tincture of myrrh and borax, only strong fluid nourishment is to be permitted; and the patient not allowed to speak. If an opening of two or three lines remain, it may be frequently closed by touching with muriatic acid; but if this be not effectual, these parts, three or four weeks after the completion of the scar, must be again stitched up. If the cleft do not unite at all, the edges soon scar with using red wine as a gargle and the pencilling just mentioned. The cleft is generally smaller.

Dieffenbach (*a*) endeavours to close such apertures in a peculiar manner. He makes on each side of the opening penetrating but parallel incisions, at the distance of a line from the edge, by which the tension is relieved, and an approach of the edges effected, which **Dieffenbach** still favours by introducing into the incision charpie soaked in almond oil. After the scarring of the latter he makes two similar incisions, though in contrary directions, which are held together in the same way.

739. Although after most of the modes of treatment for effecting the suture of the palate successful results occur, yet is the above-described simple mode of treatment to be considered most preferable, as from my own experience I have proved. That the lead wire has not the many inconveniences attributed to it by **Graëfe** and **Schwerdt** (*b*), that by its hardness it presses, by its weight it tears, that cutting-in is not prevented, and that severe traumatic re-action is produced, have been long since disproved by the satisfactory and numerous results of **Dieffenbach**'s practice even in the most difficult cases. To him owe we especially the greatest thanks in reference to his perfection of suture of the palate.

740. Even when the cleft is perfectly closed, the speech only becomes gradually more distinct as the tension of the soft palate subsides. The person operated on must first use himself to utter single letters, and afterwards syllables and so on.

(*a*) Article—*Staphyloraphie*; in Dict. de Méd., ou, Répert. gén. des Sciences Médic., vol. xxviii. p. 547.

(*b*) **Schwerdt**, above cited.

(*c*) Above cited, vol. viii. p. 102.

IV.—OF THE OLD DIVISION OF THE FEMALE PERINEUM.

Noel; in Journal Général de Médecine, vol. iv.

Saucerotte, ibid., vol. vii.

Mursinna; in **Loder's** Journal, vol. i. p. 658.

Viet, De Ruptura Perinæi. Goettingæ, 1800.

v. **Fabrice**, C. E., Medicinisch-chirurgische Bemerkungen und Erfahrungen. Nürnberg, 1816. p. 1.

Schreger, Annalen des chirurgischen Clinicums auf der Universität zu Erlangen, 1817, p. 73.

Roux, in Journal Hebdomadaire, vol. i. No. iii.

Dieffenbach, Chirurgische Erfahrungen, besonders uber die Wiederherstellung zerstörter Theile. Berlin, 1829. No. v. p. 64; and in the Medicinischen Vereinszeitung in Preussen. 1837. No. 52.

Duparque, Histoire complète des Ruptures et Déchirures de l'Utérus, du Vagin, et du Périnée. Paris, 1836. 8vo.

Mercier; in Journal des Connaissances Medico-chirurgicales, 1839, March, p. 89.

741. Tearing of the *perineum* may be consequent on difficult labour, when there is disproportion between the size of the child's head and the extensibility of the external organs of generation or artificial narrowing. The tear is often only at the *vaginal* edge of the perineum, but frequently extends throughout the greater part, more or less following the *raphe* to the edge of the *rectum*, or the whole *perineum* is torn into the *rectum*. Slight tearings of the *perineum* are of little consequence and generally heal without assistance, the patient remaining constantly on her side with the thighs kept close together, and proper attention paid to cleanliness. But this rarely happens in large tears, as the wound is continually fouled by the lochial discharge, and at every time of going to stool the wound is opened. In complete tearing of the *perineum* between the *vagina* and *rectum* it is quite impossible to retain the stool if the greater part of the *sphincter ani* be torn. If in a torn perineum union cannot be effected, the two edges of the wound skin over, and the cure is only possible by removing the skinned edges and by union with the stitch.

From what has been said, it follows that in considerable tears of the *perineum* it is most safe immediately to effect its enclosure by stitching. It must not be overlooked, however, that the parts are rarely in a suitable condition for quick union, and that if there be swelling and inflammation of the edges of the wound, union is thereby contra-indicated. If the woman herself object to this treatment, if accompanying indisposition, or the circumstances already mentioned forbid it, the position on the side must be persisted in, with the thighs a little drawn up towards the body and tied together (1), care also being taken for proper cleanliness, for soft motions, and for drawing off the urine from time to time with the catheter. The healing which in this way takes place in small tears of the *perineum*, does not depend on any union of the edges, but on its shortening backwards, so that the *labia pudendi* extend back and occupy the place of the former wound. The greater the tear the shorter becomes the *perineum*, and the longer, on the contrary, the *labia* and great fissure, the former at the same time losing their fulness, and becoming thinner. If the tear of the *perineum* extend into the *orificium ani*, the *labia* are drawn backwards by the scarring, and their hind extremities are held together by whitish callous scar; it seems as if the *anus* had moved further back, and the *labia* were drawn with it.

Sometimes there is a central tear of the *perineum*, and the whole child is thrust through it (*a*). The cure in this case may be effected by the natural powers; but if the tear extend on the sheath of the *rectum*, it has never been seen to take place.

Large and recent tears of the *perineum* can be alone satisfactorily treated with the stitch, as all other remedies proposed for bringing the wounded edges together, either

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(*a*) **Dupuytren, Pourchier**; in Gazette Médicale, vol. iii. First Series, pp. 684, 866.

graduated compresses on both sides, and fixing them with bandages, (Jörg.) Moulin's perineal forceps (*a*), or the introduction of different bodies into the *vagina* for the purpose of removing and absorbing all fluids, are extremely uncertain.

[(1) Duparcque does not agree with drawing up the thighs. He says:—" I think it better to leave the thighs completely extended, a position, in which the buttocks being more close together, at the same time diminishes the perineal space." (p. 422.) He also thinks other means more effective in producing compression may be had recourse to, and mentions a case in which he " introduced into the *vagina* a large flattened gum elastic pessary, having a large central aperture, into which he fixed the funnel-shaped extremity of a large elastic tube. The pessary pretty exactly fitting the *vagina* prevented the lochial discharge filtering between it and the sides of the canal, and consequently from getting between the lips of the tear. As the instrument reached above the top of the wound, it could not prevent the meeting of its edges; besides, the compression which it exercised on the *rectum* contributed to keep up the constipation he desired." In addition to this he placed a long cotton cylinder along each side of the torn *vulva* and *perineum*, confined them by a double-tailed T bandage, the tails of which, continued between the trochanters, and ischial tuberosities, had their inner edges brought together by sewing. The case did well.]

742. Small tears of the *perineum*, cured as already mentioned, are accompanied with no further inconvenience than with the disagreeableness of a great width of the *vagina*. Larger tears cause besides the usual relaxation of the *vagina*, protrusion of its front or hind wall, also dropping and prolapse of the womb; the ability of retaining the stools is not prejudiced, but wind frequently escapes, and in *diarrhœa* the needs are very pressing. As the woman is generally alarmed at her condition, such cases rarely become the object of definite treatment. The changes of the external generative organs thereby produced, are, however, of such kind, that all simple tears of the *perineum* should be treated with the greatest care. In the old tears which have extended into the vent, the impossibility of retaining the stools continues; at least, in that case the flatus and soft motions pass away unexpectedly on the slightest excitement.

[" Slight cases (of torn *perineum*) will often," says Dr. Churchill (*b*), " heal without assistance. Even when the rent is more extensive, a cure may be effected without further interference than great cleanliness, keeping the patient in one position, so as to preserve the edges of the wound in contact, and constipating the bowels after free purgation." (p. 409.) My friend Dr. Waller informs me that most of the cases of torn *perineum* which have come within his knowledge, have done well without any operation: and that even after the most severe tears, as when the *m. sphincter ani* is torn through and both *rectum* and *vagina* are laid into one, he has known instances of recovery with capability of retaining the motions, and with the simple inconvenience of the patient being compelled to hasten quickly to the water-closet, immediately on feeling the slightest disposition to go to stool, as when the motions approached the vent they could not be restrained from voidance. How under such circumstances the stools are retained may perhaps be explained by Dr. Burns's observation (*c*), that " it sometimes happens that the torn extremity of the *rectum* or the anterior parts containing a fragment of the sphincter or a portion of the internal sphincter, as it has been called, forms a kind of flat valve, which rests on the posterior surface at the coccyx, so that the orifice now resembles a slit, and the fæces, unless very liquid, remain in the hollow of the *sacrum* and do not pass through the valvular orifice till an effort be made to expel." (p. 68.)

The scarring of the lips of the torn *perineum* Duparcque describes as taking place " in two directions; at first in its thickness, so that the skin of the *perineum* and the mucous membrane of the *vagina* approach and run into each other, except where the perineal partition is very thick and there an intermediate scar is produced, having the characters of mucous membrane. The scarring occurs also at the same time in the longitudinal direction of the lips of the wound; this shortening is only effected at the expense of the tissues corresponding to the angles. In the case of tearings of the *furcula* and *perineum*, the *labia* which alone can readily stretch, are then drawn back by this mode of scarring; thus we may be assured that in women who have had the

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(*a*) v. Froriep's Notizen, vol. xxiii. p. 26.

(*b*) Observations on the Diseases incident to Pregnancy and Childbed. Dublin, 1840. 8vo.

(*c*) Principles of Midwifery, &c. 6th Edit. London, 1824. 8vo.

furcula deeply torn, the size which the *vulva* has preserved depends in great part on this lengthening of the *labia*; sometimes even their commissure is confounded with the margin of the *anus* without any distinguishable trace of intermediate scar. This mechanism of the scarring explains, why the existence of a bridle separating the *vulva* from the wound, in central tearing of the *perineum*, renders scarring much more difficult and tedious than when the tear has been complete. In reality, the presence of this bridle, which is formed by the posterior commissure of the *vulva*, preventing, to a certain degree, the assistance afforded to the scarring lengthways by the elongation of the *labia*, either retards it considerably, or causes a fistulous opening. Cut this bridle, and you then observe the scarring, which up to that period had seemed stationary, make rapid progress and completely perfected." He farther observes, that "what has been mentioned in regard to the *vulva* applies also to the *anus;* it is by a similar mechanism, that tearings or ruptures which involve this opening and a part of the recto-vaginal partition, scar; the scarring occurs both in the direction of thickness and length; by the latter the extremities of the divided *sphincter ani* stretch and approach the rectal angle of the wound, contributing more or less to fill it up; the *anus* is then actually enlarged. In fact, the sphincter being then much outspread, at last embraces nearly the whole of this very large *anus*, which to a certain point is only as large as ordinary. Thus the excretion of the stercoraceous matter, which was involuntary, often terminates by returning to the natural control of the will. On the other hand, the edge of the rupture formed by the recto-vaginal partition, having been drawn together, in consequence of this mode of scarring, descends lower, forms a sort of spur, a kind of valve which opposes itself to the passage of the intestinal contents into the *vagina*, which had previously occurred. Thus, then, the deep ruptures or tearings of the *perineum* extending to the anus and recto-vaginal partition, may be had without any other inconvenience than that resulting from a very large opening." (p. 415–18.)]

743. Operation on an old tear of the *perineum*, when extending into the *rectum*, is always most uncertain as to its consequences, and so much the more so if the tear be large, and connected with loss of substance and much callosity of the edges, and if the endeavour to bring the edges together be fruitless. In bad condition of the powers, in lymphatic scrofulous persons, in habitual *diarrhœa*, the operation is contra-indicated if these evils cannot be got rid of by suitable treatment.

744. The skinned-over edges of the torn *perineum* are to be refreshed in the following manner. After suitable purging, the patient is to be laid on either side, with the thighs drawn up towards the belly, so that the breech projects beyond the edge of the bed, or she is to be laid in the same position as in cutting for the stone. If the *perineum* be covered with hair, it must be carefully removed. An assistant separates the buttocks from each other, and holds back any accompanying protrusion of the *vagina*. The operator, after having ascertained the extent and state of the separation, takes hold of the lower edge of the cleft with a pair of forceps, used as in the operation for entropium, and cuts off the part taken hold of with a bistoury, or less advantageously with scissors. He then proceeds with the upper edge in a similar way, and freshens both edges of the cleft to such extent as will enable them to unite; care is also to be taken that no part covered with skin remain. As soon as the bleeding has been perfectly stanched with a sponge dipped in cold water, and all the clotted blood has been removed, the cleft is to be united with two interrupted sutures, for which purpose a sufficiently strong curved needle, with a handle, and furnished with waxed threads, is to be introduced and thrust through the whole thickness of both edges, an inch and a half from the angle, the threads being drawn after it; and, in this manner, four lines nearer the *pudendum* a second, and if the size of the cleft require it, a third bundle of threads is to be introduced. The edges of the wound after proper cleansing are to be brought together, and the threads next the *rectum* are to be drawn together with a double knot sufficiently

to bring the edges of the wound into contact. Instead of the interrupted, the quill stitch may be employed, which by its equal operation on all parts of the wound keeps the union close, as is especially confirmed by Roux's successful results. The wound is to be covered with a pledget and compress, which may be fastened with a T bandage or left uncovered; or a piece of sponge is applied, which is preferable, as the fluid flowing from the *vagina* does not collect upon the superficial pieces of the bandage. If in the union there be much tension of the edges of the wound, two parallel cuts must be made through the skin (Dieffenbach.) The patient should remain after the operation upon her side, with the thighs drawn up and close together.

This operation was first proposed by Ambrose Paré, and successfully performed by Guillebonneau; Mauriceau, La Motte and Smellie have recommended it; Noel and Saucerotte have successfully practised it; and subsequently it has been undertaken by Dupuytren, Mursinna, Menzel, Osiander, Dieffenbach, Montain, Roux and others. The mode of proceeding as to refreshing the edges is the same in all cases but varies considerably as regards the union. Guillebonneau employed the interrupted stitch; Moriceau, La Motte, and Smellie recommend the suture with penetrating stitches; Noel, Saucerotte employ the twisted stitch; Dieffenbach both it and the interrupted; Roux and Montain the quill stitch. Ritgeon (*a*) took a thread with two needles, thrust the one deeply on one side into the cleft at the edge of the skin, and carried it through an inch from the edge of the wound into the *vagina*, where he drew it tight with a slip-knot. In this way the membrane of the *vagina* is brought together in several folds, which keep the fluid from the wound. If there be at the same time injury of the *m. sphincter ani* the twisted stitch must be applied.

[In a successful case operated on by Davidson (*b*), he "passed deeply a strong double ligature by means of a common curved needle, close by the edge of the *rectum*, and another, rather more than half an inch from the first, towards the *vagina*; after which, he pared the edges of the wound, which he had not previously done, that he might not be annoyed by the oozing of blood, so as to be enabled to place the ligatures more accurately. The ligatures being introduced, he employed as cylinders two pieces of elastic gum catheter, about an inch and a-half in length, one of which was placed in the loops which the double ligature formed on one side, and the other between their separate ends, tying them firmly upon the cylinder." To prevent the eversion of the edges of the wound, which Roux found to be produced by the quill suture, and which he remedied by several small stitches at different points between the sutures, Davidson "armed a curved needle with a piece of narrow tape, four inches long, having a knot at one end; this was down each end of both cylinders about half an inch, and brought outwards, the end of the tape being prevented slipping through by the knot: the tapes were then placed in such a situation as to be intermediate to the ligatures; this being done, he turned the cylinders gently towards the edge of the wound, and tied the corresponding tapes over it." p. 225.]

745. The principal object after the operation is to produce, by the use of gentle purgatives, daily, soft motions, which should be received into a draw-sheet, and the patient must strain as little as possible. The urine must be received into a tin receptacle from which a leathern pipe passes into the night-stool, without needing any change of posture. Only when there is retention of urine the catheter is to be used, directed merely by the fore-finger of the right hand. The dressing is to be renewed as often as cleanliness requires, and if there be any unnatural secretion from the *vagina*, cleansing injections are to be used each time. Between the eighth and twelfth day the threads are to be removed and the *perineum* covered with charpie dipped in lead wash. If the union be only partial, the inconvenience is, however, often diminished; but if this be not the case a second closure must be undertaken. Many observations prove that a perfectly united *perineum* remains uninjured in a subsequent labour.

(*a*) Gemeinsame deutsche Zeitschrift für die Geburtskunde, vol. iii. pt. 1. p. 168.
(*b*) Lancet, 1838-9, vol. ii.

Attempts have been made to sustain an artificial retention of the fæces, for six or eight days, and even longer, so that the union might be undisturbed. **Dieffenbach** gives, for two days prior to the operation, little but nourishing food, then a laxative, and on the day of operation an opium pill to produce and to keep up costiveness for six or eight days, after which he gives castor oil. But with all care and employment of remedies for facilitating the discharge of fæcal matter after long costiveness, their discharge is very difficult, accompanied with severe effort, and may destroy the scarcely effected union. Thus in **Saucerotte**'s case, in which the union failed, the stitches tore on the eleventh day on account of the violent effort in going to stool, and in which a second operation, in which a tight suture had *cut through* the *m. sphincter ani*, succeeded, care having been taken for the easy relief of the bowels. **Roux** employed in one case costiveness, which the patient had learnt by refraining from food, and by the use of opium, so perfectly to effect, (for the purpose of improving the unpleasantness of her situation,) that the motions were retained till the twenty-second day, and on account of their hardness required to be helped forward by pressure of the finger from the *vagina;* he recommends, however, on the contrary, when not habitual costiveness is to be relied on, to render the excrements fluid, and he proposes this as a principal point in the after treatment.

[In **Davidson**'s case, the bowels were constipated by opium, the urine drawn off night and morning, and the diet was confined to small quantities of gruel and hard biscuit. The ligatures were removed on the seventh day, the union being complete. After nine or ten days the urine was voided naturally, and on the seventeenth the bowels were relieved. At the end of six or seven weeks she went about as usual.]

Horner (*a*) recommends, after the union is perfected, to cut through the *m. sphincter ani*, so that the sutures should not be torn out in going to stool.

Old perineal tears rarely heal by quick union; on the contrary, experience shows that such are more liable, by suppuration and ulceration, to a change, whereby indeed its connexion cannot be again naturally produced, but a certain continuity of skin may be attained, similar to the formation of a mucous membrane, which, from the pressure and rubbing in walking, becomes gradually insensible, and thus the patient's condition is much improved. In all cases in which, where the long continuance of the perineal tear gives less hope of the quick union, or where it is not effected, this mode of skinning over should be attempted, in which the callous edges are removed, the inflammation properly excited by digestive remedies and by lunar caustic; but especially by keeping from the wound the fæces and urine, and, if the granulations will not harden, to endeavour to effect this by the use of lead or zinc. **Schreger** (*b*).

Nevermann's proposition (*c*) may be mentioned, to persons fearing the knife, to strew upon the skinned edges unslaked lime, or strips of linen powdered with lime, which, after sufficient operation, is to be washed off, and the patient kept perfectly still with her thighs together.

B.—OLD SOLUTIONS OF CONTINUITY WHICH SUPPURATE.

I.—OF ULCERS.

First Chapter.—OF ULCERS IN GENERAL.

Astruc, J., Traité des Tumeurs et des Ulcères, &c. Paris, 1759–68. 2 vols. 12mo.

Bell, B., A Treatise on the Theory and Management of Ulcers, etc., 1778. Edinburgh, 8vo.

Hebenstreit's Zusätze zu **Bell**'s Abhandlungen von Geschwüren. Leipz., 1793.

Weber's allgemeine Helkologie, oder nosologisch-therapeutische Darstellung der Geschwüre. Berlin, 1792. 8vo.

Bertrandi, A., Opere Anatomiche e Cerusiche. Torino, 1786–96.

Henke, Fragmente über die Pathogenie und Therapie der Geschwüre; in **Horn**'s Archiv., vol. ii. p. 1.

(*a*) American Journal, 1837. (*b*) Above cited, p. 75. (*c*) Above cited, p. 487

Rust, J. N., Helkologie, oder über die Natur, Erkenntniss und Heilung der Geschwüre. Wien, 1811. 2 vol. Second Edit.; with copper plates. fol. Berlin, 1838.

Rust, J. N., Einige Bemerkungen über das Wesen der Geschwüre. Ein Beitrag zur Bearbeitung der Helkologie; in his Magazin fur die gesammte Heilkunde, vol. xii. pt. iii. p. 512.

Rust, C., De Ulcerum diagnosi et ætiologia nonnulla; cum tab. vii. col. Berol., 1831. 4to.

Bluff, M. J., Helkologie. Lehre von Erkenntniss und Behandlung der Geschwüre. Berlin, 1832. 8vo.

Hunter, John, Lectures on Surgery. Palmer's Edition. Vol. i,

746. An *Ulcer* (*Ulcus*, *Helcoma*, Lat.; *Geschwür*, Germ.; *Ulcère*, Fr.) is a long existing division of organic parts depending on irregularity of the vegetative processes, and accompanied with the secretion of an ichorous and sanious fluid, and a continuing destruction of the parts in which it is situated. Ulcers are therefore distinguished from abscesses and suppurating wounds, but may originate from them, if by a change of vitality in the suppurating surfaces the process of *regeneration* be converted into *ulceration* or ulcerative absorption.

747. The causes of ulcers are either *internal* or *external*. The former consists in a peculiar deviation of the whole organism, or of single organs, from the natural type, with a great degree of weakness and flabbiness, or with those diseases, of which the ground depends on some change in the assimilation, for instance, acute and chronic eruptions of the skin, scrofula, syphilis, gout, scurvy, dropsy, suppression of the usual discharges, and the like. These diseases, either of themselves, or after the operation of an occasional cause, produce an ulcer. The external causes are all injuries which, producing inflammation and suppuration, break up the connexion of parts; wounds, abscesses, the healing of which is prevented by an existing disease, or by improper treatment; specific diseased matter operating locally, and the like.

748. Ulcers are divided into *simple* and *complicated*. Simple ulcers are those which are connected neither with peculiar local nor general disease, but depending only on the decided destruction of connexion which accompanies them, according to the condition already stated (*par.* 746.) *Complicated* ulcers are, on the contrary, those connected with peculiar local or general disease. In regard to local complication, there may be distinguished *fistulous*, *callous*, *œdematous*, *varicose*, *fungous*, *sloughy*, and *carious* ulcers; further, ulcers, with a secretion of thin, lardy, acrid, stinking, saline, and variously coloured matter. General complications consist in the presence of the diseases' and dyscrasies above mentioned (*par.* 747); hence are distinguished *atonic*, *scorbutic*, *scrofulous*, *arthritic*, *syphilitic*, *carcinomatous*, and *impetiginous* ulcers.

From what has been said it results that ulcers may be *local* and *general* ailments. It is, however, to be herewith remarked, that ulcers which at first depend on a decided internal cause, often previous to healing, become merely local; and so, on the contrary, those which at first were actually local, in their course draw the whole body into participation, and may become complicated ulcers.

749. The reaction of ulcers upon the whole organism varies according to their nature. In specific ulcers the general indisposition is increased by the absorption of the pus secreted in the ulcers, and tainted with the specific poison. In ulcers in which the secretion of pus especially is very great, and of a bad kind, there arises a general weakness, partly from the

continual loss of the juices, partly from absorption of the bad pus; in the end complete *cachexia*, with altered pulse, often chills alternating with heat, difficult breathing, drawing pains in the limbs, dryness or great secretion in the ulcer, purulent urine, dropsical swellings, colliquative sweats, and *diarrhœa*. If the ulcer be of long standing, its secretion operates in relation with the other secretions, and the ulcer is to be accepted into the series of natural secreting organs. This is especially the case in old persons, in whom, with long-continued ulcers, the urinary secretion is considerably diminished. Ulcers may, therefore, themselves be considered as useful discharges in certain cases, and belong to the relative well-being of the patient so affected.

750. The *prognosis* in ulcers varies:—1. *According to the nature of the cause* which produces or sustains it. 2. *According to the position of the ulcer.* Here the importance of the affected part and of the neighbouring tissues must be considered. Ulcers in the skin and in fleshy parts heal more readily than those in tendinous parts or glandular organs. Ulcers in bones are always very intractable. In parts distant from the heart the cure is always difficult. 3. *According to the duration and external form of the ulcer.* The older an ulcer is, the more tedious is its cure, and if this be forced, dangerous symptoms may be produced by suppression of its usual secretion. The more foul an ulcer is, the more spotty its bottom, the more everted and hardened its edge, the more ill-conditioned the fluid secreted in it, the deeper it penetrates and the larger the destruction of soft parts which it produces, the more difficult is the cure. Round ulcers are generally more tedious in their cure than oval ones. 4. *According to the constitution and age of the patient.* In young subjects, if the constitution be little affected by the reaction of the ulcers, the healing is quicker than in old and already much debilitated persons.

751. The *treatment* of ulcers in general, depends on the removal of the causes which have given rise to them, and on such alteration in the living activity of the ulcerated parts, that by the natural manifestation of the reproductive processes the destruction of continuity may be again repaired.

In the progress of ulcers towards healing three stages are to be noticed: 1. *The stage of purification* (*Stadium Digestionis*, *Detersionis*); the ulcer loses its foul appearance, and instead of ichor, good pus is secreted. 2. *The stage of the formation of granulations* (*Stadium Incarnationis*, *Granulationis.*) 3. *The stage of scarring*, (*Stadium Cicatrizationis,*) in which the granulations become harder, become connected, and are covered with a delicate skin.

752. The treatment must be variously directed, according to the *cause* of the ulcer, its *living disposition*, and its *form*. First, of its treatment in reference to the latter two points.

753. Every ulcer may have an *inflammatory*, *erethetic*, or *torpid* character.

In the inflamed condition of an ulcer which is produced, either by the constitution of the patient or by the improper use of irritating remedies, the parts surrounding the ulcer are swollen, hot, and painful; its base is much reddened, sensitive, covered with white streaks, and the secretion of pus especially small. In these cases every local and general irritant must be removed, the ulcer covered with lukewarm softening fomentations, poultices, or mild salves, and in strong constitutions, even general antiphlogistic treatment must be employed. In proportion as the inflammation diminishes, the secretion of pus increases.

If an ulcer be in an erethetic condition, its base is also very much reddened, but its sensibility extraordinarily increased. Here are serviceable narcotic remedies, both internally and externally; rubbings in of warm oil of henbane, poultices of hemlock, henbane, and the like.

In torpid conditions, depending on local or general weakness, the ulcer shows relaxation; the surrounding parts are pale, relaxed, and œdematously swollen; the ulcer is insensible, and secretes a quantity of ill-conditioned thin pus. Here such local and general treatment must be employed as may increase the living activity and thereby promote the secretion of good pus. (Compare *par.* 62.)

754. The variety of ulcers, in reference to their form, requires peculiar attention in their treatment.

The *Foul* or *Gangrenous Ulcer* (*Ulcus putridum, gangrenosum*, Lat; *faule oder brandige Geschwür*, Germ.; *Ulcère gangréneux*, Fr.) is characterized by a foul, grayish-yellow or blackish surface, by insensibility, and by the secretion of a discoloured very fetid pus; the sloughy character often spreads over the whole extent of the ulcer and the parts are either gangrenous or sphacelated. The causes of this change in the ulcer may be neglect of cleanliness, improper treatment, impeded circulation, foul air, bad food, gastric impurities, weakened constitution, debility of the vascular system, *cachexia*, and the like.

The *treatment* consists in removing the causes, and in employing such remedies as promote throwing off the gangrenous parts or the restoration of those, not yet completely destroyed to their natural vitality, which is to be attempted by the use of internal and external remedies. Bark, valerian, camphor, naphtha, the mineral acids, and so on, are employed internally; externally, decoction of bark, or oak bark with lime water, of walnut shells, of water-germander, with spirits of wine, vinegar, and so on; aromatic spirituous washings of the surface surrounding the sore, charcoal powder with bark, oil of turpentine, digestive salves of myrrh, or camphor, solution of chloride of lime, fermenting poultices of flour, yeast, and honey. In general the resins or essential oils are more effective than moist remedies. If general dyscrasy exist, suitable remedies must be employed. When portions of the surface of the ulcer have separated, they must be removed; and cuts made when collections of pus beneath the destroyed parts are to be feared. Frequent cleansing especially, the local application of oil of turpentine, spirituous remedies, tincture of aloes, or sublimate, must be had recourse to against the worms and maggots which are not unfrequently produced in these ulcers. More suitable than these numerous and in their operation very different remedies, is the use of mild aromatic applications, or poultices, by which the living activity is best increased, and the foul smell also diminished, as already mentioned (*par.* 72) in the general treatment of gangrene.

The solution of chloride of lime in water in different proportions, according to the vital disposition of the ulcer, is recommended as most highly efficient in gangrenous, and especially in foul and torpid ulcers (Percy, Labarraque.) Lisfranc (*a*) bandages the ulcer with a moistened compress, and applies on it charpie soaked in a solution of chloride of lime. Lemaire (*b*) uses one part of chloride of lime and three parts of water. Ekl (*c*) first employed fifteen grains of chloride of lime in eleven ounces of water, and afterwards four grains to an ounce. According to Klimatis (*d*) it should

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(*a*) Révue Médicale, 1821.

(*b*) Archives Générales, vol. ix. p. 138.

(*c*) Rat. med. in schola cl. med. et chir. univers. Landish, 1826.

(*d*) Froriep's Notizen, vol. xvi. no. 7, p. 107.

only be applied when all inflammation has subsided. **Biett**, **Cloquet**, and others have used it with much advantage; and according to **Cuillvier** and **Boulay**, the ill smell is immediately got rid of on its application (**Pigné**).

755. The *Callous Ulcer* (*Ulcus callosum*, Lat.; *callöse Geschwür*, Germ.; *Ulcère calleux*, Fr.) is surrounded by a whitish, dry, insensible edge, not unfrequently of considerable thickness, and cartilaginous character. This callosity often spreads over the whole ulcer. The cause of this change is a want of blood or of the nourishing juices in the edges of the ulcer; hence these callosities occur most commonly in old persons, in those places where naturally the course of the blood is languid, or is prevented by accidental pressure, in bad treatment, in the improper use of relaxing ointments, or as consequent on a continued irritable condition of the edges of the ulcer, whereby a stagnation of the juices, and a similar change is produced, as in induration. Such callosities prevent the cure of the ulcer, and must therefore be resolved or removed. Only when they are not very hard, and quite insensible, softening, and at the same time exciting, applications of aromatic vegetables may be employed, the *empl. de cicutâ cum ammoniaco,—mercuriale,—gummosum, saponatum, diachylon cum gummi;* a solution of *muriate of ammonia.* If these remedies be of no avail, then we must proceed to the use of escharotics, as butyr of antimony, lunar caustic, caustic *ammonia*, a solution of caustic potash; scarification, or complete removal of the callosity with the knife, if the situation of the ulcer permit.

756. The *Œdematous Ulcer* (*Ulcus œdematosum*, Lat.; *œdematöse Geschwür*, Germ.; *Ulcère édémateux*, Fr.) is, in its origin, connected with dropsical swelling, which receives the impress of the finger; its edges are flabby, pale, often even œdematous; the granulations pale, and the secretion of a watery ichor very copious. The causes are either local, mechanical, or internal, as pressure on the vessels retaining the blood, general or local weakness, lymphatic habit, and the like. The treatment of this ulcer requires, besides the removal of the cause, and beside those remedies which alter the torpid character of the sore, a continued compressing bandage, by swathing the whole part on which the ulcer is situated.

757. *Fungous Ulcers* (*Ulcera fungosa*, Lat.; *schwammigten Geschwüre*, Germ.; *Ulcères fongueux*, Fr.) are beset with growths either on their entire surface, or only on certain parts, or at their edges, which vary considerably as to their condition, being sometimes flabby, pallid, or deep red, insensible, and bleed easily; sometimes they are of a more firm character, have a bluish red colour, and are very sensitive. The former are merely unnatural growths of the granulations, but the latter must be considered as malignant degenerations. The causes of this fungous degeneration may therefore be, long-continued torpid condition of the ulcer, improper use of debilitating remedies, too slight bandaging, the neighbourhood of carious bone, or the carcinomatous condition of the ulcer. The removal of such growths, which is necessary for healing the ulcer, is effected, if the granulations be of moderate growth, by a simultaneous treatment corresponding with the vital disposition of the ulcer, by a suitable compression with dry charpie, and frequent touching with lunar caustic; but if they be more considerable and exist as a malignant degeneration, they must be removed by the energetic application of *escharotics*. by *cutting off*, or by *tying*. The usual escharotics are *lun r*

caustic, *caustic potash*, *butyr of antimony*, *sulphuric acid*, *sulphate of zinc*, *burnt alum*, and the like These should be especially employed if the fungous growths be equally spread over the whole surface of the ulcer. The dry escharotics may be strewed upon the sore, or applied in form of ointment; the fluid painted on with a pencil after the ulcer has been properly cleared of the effused ichor. The former are more suitable rather in a flabby state of the fungous excrescences, and great secretion of ichor; the latter in greater firmness of the growth, and less effusion. If the fungus grow only partially from the ulcer, it may be most easily removed with the knife, by cutting it off at the base; by tying, when the fungus has a neck, and the patient dreads the knife, and much bleeding is feared from the excision. In those cases in which the remedies prescribed do not effect the destruction of the excrescence, or may produce awkward symptoms by their fluidity and spreading, if the use of the knife or ligature be not possible, then the destruction of the fungus is only to be effected by the use of the actual cautery. The bleeding which often arises spontaneously, or in either of the preceding modes of treatment, from the fungous surface, must be stanched by styptics, compression, actual cautery, or by the entire removal of the fungus.

758. *Varicose Ulcers* (*Ulcera varicosa*, Lat.; *varicosen Geschwüre*, Germ; *Ulcères variqueux*, Fr.) occur most commonly in the lower extremities; are for the most part oval and superficial; their base bluish, their secretion serous and bloody; the edge in old ulcers mostly callous, and the surrounding skin brown; accompanied with varicose veins of the leg, especially around the ulcer, and œdematous swelling. Not unfrequently do they bleed periodically; ordinarily they are not painful, but frequently very painful, even without any trace of inflammation. These ulcers are in direct relation to the varicose affection, and all those evils which produce hindrance to the return of the blood, as pressure, continued standing, remaining in warm or cold moisture, must be considered as their cause; hence certain trades, pressure of the pregnant womb and the like. Predisposition to varicose affections is grounded especially on plethora, full juicy lax habit, venous stagnation, and loaded state of the intestines; hæmorrhoidal disposition; suppressed hæmorrhoid and menstruation. Hence it happens that, in many instances, these swellings of the veins are only symptoms of a deeper affection, and may even belong to the relative well-being of the patient. They arise either from accidental injury in existing varicosity, or from the blood-knots running into suppuration; or other ulcers of a specific character are converted into them.

In the *treatment* of these ulcers, their causes must be first attended to; venous stagnation and loaded bowels must be relieved by purging, regulation of the mode of life, diminished standing, relief of pressure, and the like. The whole ulcer is to be simply covered with dry charpie; but the varicose and œdematous swellings are to be especially counteracted by swathing with bandages, and by the circular application of sticking plaster. If the cure be effected, its recurrence must be prevented by careful diminution of the occasional causes, with continued swathing by means of laced stockings of dog's skin (*a*).

The rules already laid down in abscesses (*par.* 65) apply to the treatment of fistulous ulcers.

759. If the ulcers have existed a long while, and have attained the

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(*a*) Kothe, Varicose Venen und varicose Geschwür an den Unterschenkeln; in Rust's Mag., vol. xxx. p. 82.

rank of natural secreting organs, derivatives by issues, and so on, must be established before they are perfectly scarred. If in the sudden suppression of the secretion of an ulcer symptoms of metastasis ensue, the ulcer should be, as soon as possible, again brought to discharge by using acrid irritating remedies. In an ulcer, where for these reasons a cure cannot and, dare not be undertaken, we are restricted to proper cleanliness, and the getting rid of local complication, for the purpose of diminishing the inconvenience which the patient suffers.

SECOND CHAPTER.—OF ULCERS IN PARTICULAR, IN REFERENCE TO THE CAUSES WHICH PRODUCE AND KEEP THEM UP.

I.—OF ATONIC ULCERS.

UNDERWOOD, MICH., A Treatise upon Ulcers of the Legs, Scrofulous Sores, &c. London, 1783. 8vo.

IB., Surgical Tracts on Ulcers of the Legs, &c. London, 1788. 8vo.

MEYTLER, F. H., Abhandlungen über die alten Geschwüre der unteren Gliedmassen. Wein, 1793. 4to.

HOME, E., Practical Observations on the Treatment of Ulcers of the Legs; with observations on varicose veins and piles. London, 1801. 8vo.

BAYNTON, THOS., A new descriptive Account of a new Method of treating Ulcers of the Legs. London, 1797. 8vo.

OSLHOF, A., Untersuchungen und Beobactungen über die chronischen Geschwüre mit besonderer Ruchsicht auf die sogennanten alten Schäden an den interen Gliedmassen. Lemge, 1804.

760. *Atonic Ulcers* (*Ulcera atonica*, Lat.; *atonischen Geschwüre*, Germ.; *Ulcères atoniques*, Fr.) are kept up by general or local weakness, which is manifested by lax fibre and flabbiness. They are mostly situated in those parts, of which the living activity, under natural circumstances, is not very great. Hence are they most frequent on the feet, of which the left is much more commonly affected than the right. Certain occupations which interfere with the flow of blood in the lower extremities, and are connected with continued standing, are favourable thereto. They are either produced by an external injury, or they may originate in independent patches, in which case there appears at some one single spot redness and slight swelling; the skin becomes thin and breaks; the ulcer enlarges, is more or less painful, and usually produces the local and general changes which have been mentioned. These ulcers are commonly accompanied with œdematous or varicose swelling of the feet, or with callous edges. They are mostly of a torpid character, though they may, from accidental causes, assume an erythetic, or inflammatory condition.

761. The *prognosis* is guided according to the general circumstances already laid down (*par.* 750); and it is to be especially noted, whether the patient can or cannot diminish the occasional causes.

762. The *treatment* of these ulcers, which seems to me most satisfactory, is the following:—If the ulcer be without peculiar complication, and if it have a good appearance, I make use, with rest and suitable support, of frequent bathings with lukewarm decoctions of chamomile flowers, and compression with sticking plaster, in the manner to be prescribed.

If the ulcer be torpid and foul, the limb must be kept in the horizontal position, warm fomentations of decoction of chamomile flowers, or solution of chloride of lime must be used; and when the ulcer has been thereby sufficiently cleansed, sticking plaster must be applied, according to **Baynton's** plan. The sticking plaster, cut in strips of sufficient length, and according to the thread, is to be applied, beginning an inch below the ulcer, in ascending spiral turns, around the ailing part, till the ulcer is completely covered. Over this sticking plaster, should the leg be swathed to the knee with a linen bandage, in order to give moderate pressure to the whole part, which is especially necessary in varicose or œdematous state of the leg. According to the quantity of the pus secreted by the ulcer, is the plaster to be renewed daily, or after several days, by which the ulcer is properly cleansed; and when scarring commences it is to be touched with a weak solution of sublimate. If the ulcers be accompanied with inflammation, erythism, or with any other complication, they must always be first brought back to their simple condition by preliminary treatment, before proceeding to swathe them in sticking, plaster. If these be attended to, and the sticking plaster be applied with carefulness, no bad symptoms, no pain, no increased development of heat, (under which circumstance the part should be moistened with cold water as often as the increased heat seems to require it,) no excoriation, nor fresh ulceration, and the like, will be observed. If the ulcer, under this treatment, be reduced to a certain point, without seeming inclined to become further healed, or if it again become worse, the cause depends either on the insufficient support of the patient, specially in his too early moving about, or there is a general ailment in causal relation with the ulcer, or the ulcer has become habitual to the patient; and, according to these circumstances, the treatment must be directed. I have never observed with this treatment even in ulcers of fifteen or twenty years' standing any symptoms arising from suppression of the usual secretions.

Underwood and **Boyer** (*a*) allow the patient to walk during the use of **Baynton's** swathing with sticking plaster, and maintain that thereby a more firm and regular scar is produced; as, on the contrary, the scar which is produced whilst the patient is kept quiet, easily breaks out again in standing and walking, on account of the stretching which it suffers in walking.

In these ulcers all the aromatic and astringent remedies have been recommended for local use; bathing the ulcer and its neighbourhood with decoction of oak bark, of willow, of the leaves or shells of walnuts, of the leaves of plantain, of the herbs water-germander, or rue, either alone, or with tincture of myrrh and the like. When the secretion from the ulcer is considerable, it is best to apply the remedies in form of powder, thus, strewing with bark, oak bark, chamomile flowers with camphor, myrrh and the like; or stimulating salves and plasters, digestive ointment with camphor, red precipitate ointment and the like.

When, on account of the peculiar state of the patient, neither rest nor swathing can be made use of, I employ, according to the degree of foulness of the ulcer, daily, a foot-bath of chamomile flowers or potash, and bind up the sore with a salve of *ung. nutrit.*, and red precipitate ointment.

Rust (*b*), in chronic ulcers of the foot, employs the hunger-cure, (quarter portion daily,) and twice a-week a purge; on the following day a lukewarm bath, and cold fomentations of soft water to the ulcer.

[In the application of sticking plaster to ulcers, or indeed when the limb requires support alone, it is much better to put it on in single straps like a **Scultetus's** bandage, than in the spiral way here recommended. The advantage gained is its more close and regular application. As to the frequency of the dressing, I prefer its renewal every

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(*a*) Rapport en conseil des hôpitaux. Paris, 1831.
(*b*) Magazin für die gesammte Heilkunde, vol. ix. p. 517.

day, whether the discharge be much or little, as by the patient's movements it slackens, and does not give the necessary support, unless daily reapplied.—J. F. S.]

763. With this local treatment must be connected internal treatment proportioned to the state of the patient. In weakness and want of tone strengthening remedies must be used; if there be stoppage of the bowels, which is very often connected with ulcers on the lower extremities, purgative and gently strengthening remedies with a regulated diet must be employed. The *gratiola* in suitable doses is advisable in these cases, as well also as when there is no stoppage in the bowels, but a general sluggishness and phlegmatic habit.

764. Relapses after the healing of atonic ulcers are very frequent, especially if the occasional causes be not diminished. They usually break out in autumn or in winter. The best mode of preventing them is perseverance in moderate compression of the foot by a laced stocking of unyielding leather; at the same time a proper diet is to be observed, and every violent motion of the foot to be avoided.

II.—OF SCORBUTIC ULCERS.

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Lind, Jas., M. D., A Treatise on the Scurvy. Edinb., 1753. 8vo.

Hulme, Libellus de naturâ, causa et curatione Scorbuti. London, 1768.

Milman, Sir Francis, Bart., An Enquiry into the source from whence the symptoms of Scurvy and of Putrid Fevers arise and into the seat which those affections occupy in the Animal Œconomy, &c. London, 1782. 8vo.

Blane, G., M. D., Observations on the Diseases incident to Seamen. London, 1785. 8vo.

Trotter, Thos., M. D., Observations on the Scurvy, &c. London, 1792. 8vo.

765. *Scorbutic Ulcers* (*Ulcera scorbutica*, Lat.; *scorbutischen Geschwüre*, Germ.; *Ulcères scorbutiques*, Fr.) are always indications of more or less developed scurvy. The immediate cause of scurvy is a disposition in the blood and other juices to decomposition and breaking up with predominating weakness of the capillary vascular system. Its symptoms are therefore all grounded on weakness, flabbiness, decay or entire destruction of the contractility of parts, which especially show themselves in the vascular system.

The natural colour of the skin fails, it becomes pale and puffy; the patient feels a general weakness, and tires with the slightest motion. The gums begin to be painful, swell and bleed on the slightest touch; the breath stinks. Upon the surface of the body appear here and there, especially upon the feet, bluish spots of various size, which spread and often enlarge into streaks. In hot climates œdematous swellings of the limbs occur. Mostly there appear on the skin small swellings with bladders, which drop in and are followed by purple-coloured spots. Pains come on in the feet, swellings of the knee-joints, ulcers, and frequent bleedings from the gums. The weakness becomes very great; the patient spits, coughs, and vomits blood; loses blood with his urine and by stool. The gums are often gangrenous; the blood is poured out in every interspace; old scars break out, and the weakness from repeated bleeding is so great that the patient faints on the least movement. He dies either in such fainting or of consumption.

766. Scorbutic ulcers are generally flat, their edges and circumference œdematous, swollen, and bluish; their bottom dirty, beset with fungous granulations, and bleeds on the slightest touch. The ichor flowing from the sore is thin, mingled with blackish blood, and very stinking. The neighbouring bone is often attacked and destroyed. They usually occur on the gums, on the calves of the legs, and thighs, either in distinct patches in severe scurvy, or from other ulcers, if a general scorbutic disposition exist.

767. The occasional causes of scurvy are, want of oxygenated air, moist foggy air, bad food, sluggishness, want of exercise or too great exertion. These causes mostly show themselves after long sea voyages on the coast of the North Sea (*Sea Scurvy.*) The influence, however, of similar evil influences may produce scurvy on shore in men of phlegmatic temperaments, who live in damp dull dwellings and feed on bad food. The land scurvy is therefore observed, especially in time of scarcity, in besieged towns and the like. A condition similar to scurvy has been also observed after the immoderate use of mercury.

[The land scurvy here mentioned is the chronic form of *Purpura hæmorrhagica* of BATEMAN (*a*), who says, that "it appears occasionally, and in its severest and fatal form, where none of these circumstances ever existed; for instance, in young persons living in the country and previously enjoying good health, with all the necessaries and comforts of life. This circumstance tends greatly to obscure the pathology of the disease; for it not only renders the operation of these alleged causes extremely questionable, but it seems to establish an essential difference in the origin and nature of the disorder, from that of *scurvy*, (the true scurvy formerly prevalent among seamen in long voyages,) to which the majority of writers have contented themselves with referring it. In scurvy the tenderness of the superficial vessels appears to originate from deficiency of nutriment, and the disease is removed by resorting to wholesome and nutritious food, especially to fresh vegetables, and acids; while in many cases of *Purpura*, the same diet and medicine have been taken abundantly, without the smallest alleviation of the complaint." (p. 110–11.)]

768. The *cure* of scorbutic ulcers requires, before everything else, the removal of the scorbutic diathesis upon which they depend, by the change of moist foggy air for warm pure air, by the use of better food, especially of acid fruits, by an active mode of life, with moving about in the open air, Further by the use of *nasturtium aquaticum*, *cochlearia*, *beccabunga*. vegetable and mineral acids, alum, aromatic bitter remedies, as the *calamus*, marsh trefoil, bark, and the like; at the same time rubbing the whole body with spirituous remedies should be advised; even washing with cold water, by which the parts are again endowed with their lost elasticity, and the coagulability of the blood is increased.

769. Upon the ulcers themselves strong astringent remedies are to be applied, bark with alum, camphor, myrrh, alum in astringent decoctions, gum kino dissolved in red wine. THEDEN's arquebusade water, fixed air, charcoal with bark, myrrh, alum, storax, astringent decoctions, with acids. Swathing the limb on which the ulcer is situated with bandages moistened with strengthening remedies is of especial use.

Gargles of bark, decoctions of oak or willow bark, of garden sage with spirit of scurvy grass or alum, and touching with diluted muriatic or sulphuric acid and honey, are the best applications against swellings and ulcers of the gums.

(*a*) Practical Synopsis of Cutaneous Diseases. Second Edit., 1813. 8vo.

III.—OF SCROFULOUS ULCERS.

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Baume, J. B. T., Traité sur le Vice Scrofuleux et sur les maladies qui en proviennent. Second Edit. Paris, 1805. 8vo.

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Carmichael, Essay on the Nature and Cure of Scrofula, and a demonstration of its origin from disorder of the Digestive Organs. Dublin, 1810. 8vo.

Henning, Geo., M. D., A critical Inquiry into the Pathology of Scrofula. London, 1815. 8vo.

Hufeland, Ch. W., Ueber die Natur, Erkenntniss und Heilung der Scrofelkrankheit. Third Edit. Berlin, 1819. 8vo.

Goodlad, W., Essay on the Diseases of the Vessels and Glands of the Absorbent System. London, 1814. 8vo.

Baudelocque, A. C., Etudes sur la Maladie Scrofuleuse. Paris, 1834. 8vo.

770. *Scrofulous Ulcers* (*Ulcera scrofulosa*, Lat.; *scrophulösen Geschwüre*, Germ.; *Ulcères scrofuleux*, Fr.) are indications of more or less developed scrofulous disease. They originate in nutrition varying from the natural type, in consequence of which bad preparation of the blood and unnatural mingling of the lymph, irregularity in the circulation of the latter, obstruction and swelling of the glands ensue.

771. Scrofulous disease is in general a peculiarity of youth; children come into the world with a predisposition to it, and the disease afterwards develops itself especially in bad nursing, want of cleanliness, bad food, and so on, This disposition shows itself under two forms:—

1. The children are sprightly, of slight bodily form, very active, their skin white, their cheeks red, their eyes sparkling and lively, their form beautifully rounded, their hair blonde, brown, fine and curly; they have especially very great excitability.

2. There appear weakness, flabby, lymphatic habit, bloatedness, especially of the face, the lips are turned up, the angles of the jaws strongly prominent. Such persons are slowly developed, suffer from want of nourishment, frequently from *blennorrhœa*, from eruptions of the skin, in which scrofula shows itself in its most revolting form, and its character is torpor.

772. Scrofula when developed gives rise to important diseases; continued inflammation and *blennorrhœa* of the mucous membranes, eruptions of the skin, swelling and suppuration of the glands, atrophy, consumption, swelling and suppuration of the bones and joints.

773. Scrofulous sores occur either when the swollen glands inflame and break, or the skin inflames at various independent spots and ulcerates. They are usually free from pain, their edges hard, irregular, and overhanging; the circumference and the swelling itself are pale or violet red; the bottom is here and there marked with streaks of tough lymph, and the pus is thin. Such are scrofulous glandular swellings or a scrofulous habit.

774. The healing of scrofulous sores depends upon the improvement of the constitution, which may be expected if there be no destruction of important parts, and no great accompanying weakness. Scrofula frequently

disappears as the development of the body advances, particularly at the time of puberty, and in females frequently at the first pregnancy.

775. The *cure* of scrofula requires especially a good dietetic treatment, strengthening and easily digestible diet, fresh air, cleanliness, and so on. The medical treatment to be employed is either strengthening or such as acts specifically on the lymphatic system: bark, *calamus*, willow or chestnut bark, bitter extracts, acorn coffee, steel, the various mercurial and antimonial preparations, muriate of barytes, *cicuta*, *belladonna*, *dulcamara*, the alkalies, burnt sponge, iodine, cod-liver oil, and so on. The remedies acting on the lymphatic and vascular system are especially suitable in lymphatic habits and large glandular swellings. The remedies mentioned must be differently combined with each other according to the patient's condition, and their favourable operation must be specially supported from time to time by purges of calomel and rhubarb or jalap. The use of the bath, particularly baths of aromatic herbs or wine, sulphur, steel, or salt water, are of remarkable benefit, especially if connected with rubbing of the whole body with flannel or spirituous remedies.

776. Attempts should be made to disperse glandular swellings by friction with volatile liniments, mercurial ointment with camphor and caustic spirits of ammonia; by irritating plasters, the *emp. mercuriale*, *de cicutâ cum ammoniaco*, *saponatum*, with camphor, opium, ox gall, and so on, and when in a very chronic state with iodine ointment. The same remedies are to be used for the disperson of the hardness generally surrounding scrofulous ulcers. If these swellings be accompanied with inflammation and pain, the repeated applications of a few leeches is advisable, with mercurial ointment, and the use of dry, or, in great tension, of moist warmth.

If the scrofulous ulcers have a torpid character, with the astringent decoctions of bark, elm or chestnut rind, and of green walnut shells, must be joined the extract of *cicuta*, *belladonna*, or chamomile; with solution of sublimate or lunar caustic with the above-mentioned additions, with red precipitate ointment, with *ung. nutrit.*, and the like. The scarring is much hastened by frequent touching with lunar caustic, and the removal of the quite loose and overhanging edges of the skin. In inflamed and very painful condition of the ulcer, warm fomentations must be applied over the sore, accompanied with a soothing and corresponding dietetic treatment.

Of late iodine (1) and cod-liveroil (2) have been considered especially important remedies against the various scrofulous affections.

(1) Lugol (*a*) holds that the continued use of iodine is the most certain remedy against scrofulous affections. He has never observed any ill consequence from persisting in the use of this remedy for any length of time; this happens only in the use of the common *tinctura iodinæ*. If oppression at the pit of the stomach come on, the iodine must be put aside, and some ounces of bark wine given.

The forms prescribed by Lugol are,—

℞ *iodinæ* gr.½—⅔—gr.j., *aq. destill.* ℔.j. —*M. ut fiat mist; quotidie captand.*

℞ *iodinæ* gr.ij.—iij.—iv. *aq. destill.* ℔. j. —*M. ut fiat lot.; assidueve frequenterve adhibend.*

℞ *potass. iodid.* ℥iv.—v.—vi., *iodinæ* ℈iv.—xiv.—xvj., *axung. recent.* ℔.j.—*Tere simul, ut fiat ung.; bis die part. affect. infric.*

Besides using these remedies the patient should observe a proper dietetic regimen, and be about in the open air.

For baths for children, the solution in the proper quantity of water should be of four degrees of strength; 1, to six ounces of distilled water, two scruples of iodine, and four

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(*a*) Mémoires sur l'emploi de l'Iode dans les Maladies Scrofuleuses; precédé du rapport fait à l'Académie par Serres, Magendie, et Dumeril. Paris, 1828.

of iodide of potash; 2, two and a-half scruples of iodine, and five scruples of iodide of potash; 3, three scruples of iodine, and six scruples of iodide of potash; 4, four scruples of iodine, and eight scruples of iodide of potash. For adults, to a similar quantity of water, 1, two drams of iodine, and four drams of iodide of potash; 2, two and a-half drams of iodine, and five drams of iodide of potash; 3, three drams of iodine, and six drams of iodide of potash; 4, four drams of iodine, and eight drams of iodide of potash. The fourth degree LUGOL does not employ, the third being the strongest he uses.

This, according to LUGOL (*a*), is the most efficient and certain mode of curing scrofula, and the conditions depending on it. My own observations, as well as those of other medical men, completely correspond with the advantage of this treatment (*b*).

(2) The cod-liver oil is to be given twice a-day, beginning with one table spoonful, and gradually increasing it up to six; to children it must be given in proportionate smaller doses. To get rid of the filthy taste, the mouth should be rinsed immediately before taking it, with cold water or with brandy, and directly after it is swallowed, a cup of herb tea, of lentain, cinnamon, or Seville orange flower should be drank. The external application of the oil in way of friction, is also very efficient for the dispersion of swellings. To be effectual, the oil must be given for a long time. Children always take it willingly, and invariably better than adults, who generally cannot overcome their antipathy to it. After the use of the oil, as well as after the use of iodine, more powerful digestion, better appetite, and even actual voracity, have been noticed. Although chemical observations have given different results as to whether iodine be contained in the oil or not, there appears to be no doubt that the various kinds of oil as met with in commerce, have given rise to the various results, as the true cod-liver oil does contain iodine, but the white oil usually does not, the latter not being cod-liver oil, but seal oil; the former only therefore should be ordered. Hence may be explained the various opinions of numerous physicians on the operation of the oil (*c*).

Fresh walnut leaves and their decoction have of late been particularly recommended against scrofula; two or three cups of the infusion of the fresh leaves daily, with syrup or honey. Also night and morning pills of three and a-half grains of the extract of the leaves, or a table spoonful of the syrup prepared from the same extract. NEGRIER (*d*). The frequently remarkable effect of POLLINI's decoction is to be principally ascribed to the walnut shells it contains.

[RUSSELL observes, that "in the treatment of scrofulous ulcers under the ordinary circumstances of the complaint, the simplest and mildest dressings answer best. When the patients are using a course of sea-bathing, it is usual to wash the sore with sea-water over and above the momentary application of the sea-water during the immersion of the whole body. Cold spring-water is likewise a favourite application with many practitioners; and from much observation, it appears that the operation of cold is well-suited to counteract the state of inflammation which accompanies scrofulous sores." (p. 105.) BURNS is also of the same opinion as to the use of cold water, but couples it with pressure by adhesive straps. If the sore require stimulating, black wash with or without mucilage of acacia, and with or without tincture of opium, is a very excellent application. But oftentimes these scrofulous sores are quite unmanageable, and will not be soothed or healed with any application. Under these circumstances our entire reliance rests on the improvement of the constitution, simultaneously with which the sores mend.

I scarcely ever use iodine, except as iodide of potash, which is a most excellent medicine, either employed internally or externally. I commonly give from three to five grains of the iodide twice a day, either in an ounce and a half of compound infusion of gentian with a drachm of any warm aromatic tincture, or in four ounces of compound decoction of sarsaparilla, and to either vehicle add a drachm of syrup of poppies, which it is well to commence with, as it will generally prevent the *nausea* which frequently occurs without it. Occasionally, after taking the iodide of potash for some days, salivation is produced, which I have observed again and again. And

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(*a*) Mémoires sur l'emploi de l'Iode et des bains iodurés.

(*b*) MÜLLER, Ueber die arzneiliche Wirkung und Anwendung der Jodine. Würzburg, 1832.

KUNZ, Ueber die Anwendung der Jodine in Scrophulösen Krankheiten nach eigenen Erfahrungen und mit vorzüglicher Berüchsichtigung der Versuche und Beobactungen Dr. LUGOL's; in RUST's Magazin, vol. xxxvii. p. 61.

HANKE, Ueber die med. Wirkung des Jods; in Journal von GRAËFE und von WALTHER, vol. xxvi. pt. iv. p. 445.

BRERA, Saggio clinico sul Iodio, &c. Padua, 1822. 8vo.

(*c*) BREFELD, Der Stockfisch-Leberthran in natur-historischer, chemischer, und pharmaceutischer Hinsicht, besonders aber seine Heilwirkungen in rheumatischen und scrophulösen Krankheitsformen. Hamm, 1835. 8vo.

(*d*) Mémoires sur le Traitement des Affections Scrofuleuses par les préparations de Feuilles de Noyer; in Archives Générales de Médecine, Third Series, vol. x. p. 399. vol. xi. p. 41. (Fourth Series) vol. iv. p. 133.

sometimes it disagrees with the stomach and the patient loses appetite and becomes worse instead of better. Under either of these circumstances it must be left off. When used as an ointment, a drachm of the salt to an ounce of lard is a very useful application; more commonly employed, however, to glandular swellings than to sores. It is best applied either simply spread upon lint, or by dressing the surface after the removal of the cuticle by a blister. Either of these modes is preferable to rubbing the ointment in, for frequently when the skin is thin and the patient irritable, after three or four rubbings the skin inflames, the cuticle cracks and it is necessary to withhold the application to prevent the establishment of a sore.

Some Surgeons are fond of painting enlarged scrofulous glands with tincture of iodine, which very commonly blisters the skin; or if it do not, it destroys the cuticle, which flakes off in large pieces. I do not think it a very efficient remedy, though by some so esteemed.

I have given cod-liver oil several times with much advantage; but it is abominably nauseous, and as it owes its efficacy to the iodine it contains, it is certainly preferable to give the iodine in some more agreeable form.—J. F. S.]

777. The scrofulous inflammation of the upper lip, nose, and cheeks, which often leads, by ulceration, to considerable destruction, in which the cartilages of the nose shrivel, is, with simultaneous general treatment, not so easily checked and diminished with anything, as by bathing with decoction of *solanum nigrum*, alone, or with the addition of sublimate or repeated touchings with nitrate of silver. When the scrofula is very inveterate and connected with considerable degeneration, a satisfactory change in the whole body, and a cure, can alone be effected by either of the last-mentioned modes of treatment, by the hunger-cure, by the smear-cure, ZITTMANN's decoction, and the like.

IV.—OF GOUTY ULCERS.

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WENZEL, Dissert. de Ossium arthriticorum indole. Mogunt., 1791.

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SCUDAMORE, CHAS., M. D., A Treatise of the Nature and Cure of Gout, &c. Fourth Edit. London, 1823. 8vo.

VON VERING, J., Heilart der Gicht. Wien, 1832.

778. *Gouty Ulcers* (*Ulcera arthritica*, Lat.; *arthretischen Geschwüre*, Germ.; *Ulcères arthritiques*, Fr.) are consequent on the existence of gout in the body, with which they are more manifestly or secretly connected. They are usually superficial, their bottom is wide, reddish brown, smooth, contracted, and seemingly very deep, from the wasting of the cellular tissue, and from the union of the skin with the underlying fibrous tissues; they secrete a quantity of serous fluid, which corrodes the parts surrounding the ulcer, and not rarely blackens the linen. Their edges are mostly irregular, pale, and hard, but under inflammation rosy and painful. They become worse periodically, from bad air, or the gouty affections become worse on the incipient improvement of the ulcer.

779. These ulcers occur either from accidental injury during general gouty affections, or after gouty inflammation and swelling, which run into ulceration; they are therefore situated mostly in the lower extremities, and in the neighbourhood of joints. Their *diagnosis* is generally easy,

though it may be difficult, if the patient, excepting the ulcers, have not suffered any decided gout. In these cases the symptoms must be especially attended to, which usually accompany anomalous gout, as disturbed functions of the bowels and liver, unnatural urinary secretion, irritating, often periodically wandering pains in the limbs; also *blennorrhœa*, eruptions of the skin and the like, which are often closely connected with the ulcer.

780. These ulcers are generally very stubborn; are often kept up by the deposition of chalky masses; their cure must therefore be undertaken with great care, because the patient is liable to the danger of a metastasis.

781. In treating arthritic ulcers the general affection must always be attended to. Above all, the patient's mode of living must be specially regulated, frequently the very contrary to the previous course directed, and therefore a change to a diet sometimes with more meat, but more frequently to a more simple vegetable food, with suitable exercise. According to the different character of the gout, means must be employed which either promote or diminish the perspiration and the flow of urine. MINDERER's spirit, antimonial wine, aconite, *guiaicum*, camphor, the various preparations of antimony, the alkalies, the *vinum seminis colchici*, and so on; or bitter strengthening remedies, the *calmus*, bark, bitter extracts, steel, or the more opening and purging remedies. Baths, especially those containing sulphur, are of very great use.

The *vinum sem. colchic. autumn.* I have proved to be generally the most efficient remedy against gout and rheumatic affections. The result of my observations and experience on this remedy, that its efficiency depends on the increased production of uric acid in the urine during its use (*a*), has been fully confirmed by the experiments of LEWIN (*b*).

782. The local *treatment* of the ulcer is guided in part by the general treatment. If the ulcer have an inflammatory character, it must, in addition to the removal of all irritants and proper general treatment, be covered merely with a dry warm vegetable poultice; all moist and wet remedies must be avoided. If the ulcer, as is commonly the case, have a torpid character, it must be covered with mercurial or cicuta plaster, with *empl. de minio* with camphor and opium, a powder of bark, camphor, and white sugar is to be daily strewed upon the sore, rubbing in mercurial ointment with camphor around the wound, and swathing the part with waxed taffeta, or the application of camphorated bags of vegetables. SCHMUCHER's plaster of *assafœtida*, soap, *ammoniacum*, and vinegar of squills often does good service, even when there is accompanying exposure of bone. In this treatment derivation must also be kept up at the same time with issues, setons, and the like.

If the ulcers do not heal, their cure must not be forced by contracting and drying remedies. The ground of their stubbornness often depends on local complication; they may be even incurable, if seated in parts which are already completely disorganized.

The earthy masses (urate of soda) often, in gout, deposited in the joints, in the cellular tissue, or in the mucous bags, is consequent on repeated inflammation and effusion thereon dependent. If they be in any quantity, the motion is more or less disturbed, and by their irritation, or by a fresh attack of gout, inflammation and suppuration are produced, the skin breaks, and the chalk-like mass is gradually discharged. A dry piece of this substance often penetrates the skin, and remains as an excrescence, without exciting inflammation and suppuration. If the collection of these masses produce

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(*a*) Heidel. klin. Annal., 1827, vol. iii. p. 345.

(*b*) ROBERT LEWIN, jun., On the physiological and therapeutical effects of *Colchicum autumnale*; in Edinburgh Medical and Surgical Journ., No. 148.

inflammation, it must be got rid of by mild treatment. If they be observed beneath the skin, the swelling must be opened; we do not then endeavour to press out the earthy masses; they gradually discharge themselves with the pus, by the continued use of softening poultices. If the inflammation be abated, the removal of the earthy mass may be often facilitated by taking away part of the overlying skin. If a large ulcer be formed with a deposit of this kind at its bottom, it is best removed by the application of caustic remedies, by which the cells containing the earthy matter are destroyed (*a*).

OF IMPETIGINOUS ULCERS.

783. Among *Impetiginous Ulcers* (*Ulcera impetiginosa*, Lat.; *impetiginösen Geschwüre*, Germ.: *Ulcères impétigineux*, Fr.) are to be considered those which form, in their course, chronic eruptions of the skin. Hereto belong the herpetic ulcer, the scalled head, milk-crust, and itch. These ulcers are to be considered throughout as symptoms of chronic eruption of the skin, and are determined by the great degree and long continuation of the eruption, by its easy recession from one part, and fixing upon another, or by mechanical influences, itch, and the like.

784. The actual causes of chronic eruptions are, principally, a bad condition of the digestive organs, stagnation in the portal system and liver, disturbance of the secretions, dyscrasy, the use of bad, putrid and acrid victuals and drink, residence in foul air, want of cleanliness, dirty employments, working among wool, acrid remedies and contagion operating on the skin. Hence impetiginous ulcers may be divided into, 1, the simply local; 2, into those which are connected with general causes; and, 3, those originating from contagion.

785. The *treatment* of impetiginous ulcers must vary according to the condition of the ulcer, and the causes upon which the eruption depends. If the ulcers be inflamed and painful, the general treatment must be to diminish irritation and to soothe. A more strict antiphlogistic plan of treatment is indeed rarely necessary; a suitable dietetic regimen, and the use of cooling purgatives, are ordinarily proper. According to the variety of the cause, the remedies to be employed must be sometimes solvent, sometimes for the improvement of the digestion and assimilation, sometimes for the restoration of the suppressed secretions. As in the constitutional, though not contagious eruptions, a morbid matter is produced and in a manner thrown off, we must assist its separation by the natural drains, the skin, the urinary organs, and the alimentary canal. The remedies which effect this object are especially sulphur, and its various preparations, antimonials, decoctions of woods, *dulcamara*, sassafras, juniper, sarsaparilla, *carex arenaria*, mezereon, pansy, and the like. In very old eruptions, and in considerable degeneration of the skin, mercurials, sublimate, and arsenic are especially useful; and the cure may often be effected merely by remedies entering into and altering the whole constitution, as the friction-cure, the hunger-cure, Zittmann's decoction, and the like, hereafter to be mentioned.

786. The local *treatment* must have special reference to the state of the inflammation, and so long as that continues, mild applications and salves, luke-warm baths and the like can alone be used. If the irritation have subsided, so long as the internal cause is unremoved, the local remedies must be used with caution, because relapse and destruction are easily pro-

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(*a*) Moore, J., On Gouty Concretions or Chalk-stones; in Medico-Chirurg. Transactions, vol. i. p. 112.

Ure, A., Ib., vol. xxiv. p. 30, recommends especially the benzoic acid, up to a scruple, after meal-time.

duced. Sulphur, sublimate, red and white precipitate, alkalies, and the like especially may be used as ointments, solutions, and baths. If the skin be completely degenerated, the application of caustic, and the entire destruction of the diseased part of the skin is often necessary. In this treatment attention must be paid to cleanliness and suitable diet, each of the above-described ailments must be diminished, and a derivation kept up by issues, setons, and so on.

A.—OF HERPETIC ULCERS.

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SCHIES, L., Dissert. de Lupo. Halæ, 1831.

The Works of BATEMAN, SCHEDEL and CAZENAVE, on Diseases of the Skin.

787. *Herpetic Ulcers* (*Ulcera herpetica*, Lat.; *flechtenartigen Geschwüren*, Germ.) are characterized by the following appearances:—at first there is perceived on some part of the skin, inflammation or little bladders, whence are produced crusts or scabs which subsequently either scale off like bran, or fall off in larger pieces, and expose an inflamed patch of the skin, from whence exudes a fluid of peculiar smell and colour, which drying, fresh crusts are produced, and these again fall off. These ulcerations generally do not penetrate deeply, but readily spread on the surface, and are usually accompanied with much burning and itching.

If the herpes spread over a large surface of the body, the perspiration is diminished, the nourishment is disturbed, the action of the bowels stopped, and at last hardening of the bowels, hectic fever, swelling of the feet and so on are produced.

788. Herpes (*Lichen*, *Serpigo*, Lat.; *Flechte*, Germ.) is divided, according to its form, into *Herpes furfuraceus*, *crustaceus*, *squamosus*, *pustulosus*, *phlyctænoides*, *erythemoides*, according as at the onset it is connected with bran-like scales, crusts, pustules, blisters, or inflammation. It is called *eating herpes* (*Herpes exedens*, *rodens*, *phagadænicus*, *Lupus*, Lat.; *fressende Flechte*, Germ.) when the ulceration (generally situated on the tip of the nose, on the cheeks and lips) spreads quickly; in this case the parts are eaten away and often considerably destroyed by an acrid fluid beneath a thick scab, or where thick brown or blackish scabs are formed upon roundish sores with bluish edges, dirty colour, and surrounding swelling, which enlarge and eat away the parts without secretion of ichor, as it were by dissolving them. When a pustulous eruption dries to a hard scab upon the hairy part of the chin and cheeks it is called

Herpes mentagra. The division of herpetic eruptions according to their external form is of little consequence, as they are remarkably changeable.

789. It is uncertain whether the proximate cause of herpetic eruptions consists in a specific dyscrasy, whether it be the same in all herpetic diseases, or whether upon its difference depends the peculiar form of the herpes. Some kinds, especially the eating kind, cannot in its advanced degree be denied to be contagious.

The disposition to herpes which may also be hereditary, depends commonly on a peculiar delicacy and sensibility of the skin, in which usually *Herpes furfuraceus* consists; the herpes mostly shows itself in those parts which are very sensible and are much exposed to the air, therefore especially on the face and hands. The remote causes are frequently stoppages in the intestines of the belly, especially faulty action of the liver, suppression of the natural or long-continued discharges, hæmorrhoids, sweating of the feet, the monthly purification and the like, diminished secretion of the skin and kidneys especially in elderly persons, previous acute eruptions of the skin or acute diseases especially. Further, uncleanliness, neglected cleansing of the skin, irritation of the skin from rough, especially from woollen clothing, or from working among wool; the use of very acrid food and drink. This herpes is often complicated with scrofulous, syphilitic, or gouty affections, and these seem to be its especial causes; although they can be less distinguished by the peculiar form of the eruption and ulcer, than by the general symptoms belonging to them. In hot climates herpes is more frequent than in cold; in our region it is more especially developed in summer; in the winter it often subsides entirely or remains stationary.

From what has been said, it is clear why the repulsion, or imperfect development of herpes, may bring about dangerous symptoms, inflammation and pain in the internal parts, spasms, convulsions, apoplexy, palsy, sudden death, stoppage in the bowels, dropsy, consumption, and so on.

VEIEL (*a*) has proposed a division of herpes, which is extremely important, both as regards the generic development and the treatment. According to his views, herpetic eruptions are either direct effluvia from the blood or diseased changes of the several organs of the skin. They are in part hereditary, derived from ancestors, and deeply rooted in the organism; in part acquired—that is, are the spontaneous crises of various diseases, as gout, rheumatism, and so on, or diseases consequent on acute and contagious *exanthemata*, as scarlet fever, itch, and so on.

The blood-herpetic eruptions are primarily produced by an apparently fluid deposit beneath or on the skin, as the reflection of disturbance in the mixing of the blood, as the immediate effluvia from the extremities of the blood-vessels. The herpetic eruptions of the skin are secondary changes of the structure of the layers of the skin, produced first of all, by a disease of the actual organ of the skin, in which either the blood selects this organ as a depôt, or in which it is spontaneously diseased. The blood-herpes is usually hereditary, shows itself in the development of the teeth as *Strophulus* and obstinate *Porrigo*; before puberty commonly as scrofula, especially as scrofulous ophthalmia; after it, as herpes, and finally as gout. The skin-herpes mostly acquired, occur as consequent of other eruptions, *porrigo*, itch, nettle rash; the blood-herpes, especially *Eczema chronicum* and *Porrigo*, from checking of the perspiration, from the mode of living, and so on. Blood-herpes is variable; it subsides and appears without discernible cause, and spreads suddenly; it prefers the vascular and richly glandular parts of the body, and selects bladders or pustules as its special form. The skin-herpes spreads constantly and obstinately, prefers the extending sides of the joint, and presents itself in scales and imperfect.

The blood-herpes, as a semicritical result of deficient mixing of the blood, repelled by external remedies, may produce dangerous consequences from metastasis, whilst skin-

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(*a*) Ansichten über Flechten in Allgemeinen; in CASPER's Wochenschrift für die ges. Heilkunde, May, 1842.

herpes, cured by external remedies, has no such dangerous consequences. The relapse of blood herpes commonly arises without any distinguishable cause or disease, especially after influenza; that of skin herpes after want of food, suspension of perspiration, after rheumatic fever, and so on. Blood-herpes depends, 1, on the quantitative misproportion of the blood: *a*, with excess of albumen, the moist herpes, *Eczema chronicum*, in which a group of capillary vessels pour out serum, whereby the cuticle is raised into bladders which seem to be grouped; *b*, with excess of fibrin the pustular herpes, *Impetigo*, in which serum containing fibrin is poured from the vessels of the *corion* into the tissue, whereby single, cellular pustules are produced: in milk-crust there is only modification from the child's age; *c*, with excess of salts of the blood, the salt flux, *Eczema impetiginoides pedum*, in which salt serum is poured forth from the veins of the skin beneath it, which reddens, destroys it, and only on the edges forms distinct vesicles; *d*, with excess of serum, chronic vesicular eruption, *Pemphigus*, chronic nettle rash, chronic tetters, in which an effusion of water in the cells of the *corion* form the tubercles or papules of *lichen*, the tooth-rash, *Strophulus*: 2, on qualitative misproportion; *a*, from itch complicated with *Eczema*, *Prurigo*, or *Scabies spuria*, in which not groups of vessels, but only single twigs pour out serum and form distinct, scarcely perceptible vesicles beneath the cuticle; *b*, from the poison of *Tinea*, complicated with *Impetigo*, *Porrigo adultorum mucosa*, little pustules on the skin of the head. Skin-herpes depends—1, on disease of the glands which form the skin: *a*, there is only a diseased scaly cuticle secreted, without the participation of the dermal tissue in the disease; little herpetic eruptions, *Pityriasis*, *Icthyosis*, and *Squammositas cutis*; *b*, an unnatural scale of skin may be deposited on the diseased *corion*; a dry scaly-herpes, *Psoriasis*; *c*, a deposit of unnatural scales on the diseased *corion*, and diseased under skin, and cellular tissue in a circular eruption, *Lepra*; if the cellular tissue be not merely inflamed but degenerated, it is *Elephantiasis*; 2, from disease of the perspiratory glands, *Miliaria chronica*: 3, from disease of the sebacious glands, *Acne*: 4, from disease of the roots of the hair, *Sycosis*: 5, from disease of the subcutaneous cellular tissue; *a*, this gradually shrinks, thereby affects the glands of the skin, so that the cuticle exfoliates in a diseased state, finally the *corion* is destroyed, and the entire spot sinks in, becomes smooth, glossy, transparent, forms on the edge little vesicles connected with the subcuticular cellular tissue, which ulcerate superficially; superficial eating herpes, superficial *Lupus*; *b*, the subcutaneous cellular tissue suppurates, produces tubercles and pustules, which freely burst through the cuticle, suppurating deep-eating herpes, *Lupus ulceratus*; *c*, single and, subsequently, confluent tubercles which raise the *corion* and cuticle, the *Lupus hypertrophicus*.

790. The *cure* of herpetic ulcers first requires the removal of the cause. In stoppage of the bowels, laxative and opening remedies are to be given; in diminished secretion from the skin and kidneys it must be endeavoured to reproduce them; in scrofulous, syphilitic, or any other complication, the treatment will direct the contrary; as the mode of living changes if it be in causal relation to the herpes, the mode of living must be especially regulated, in most cases less animal and more vegetable food, but in others more strengthening though always simple diet must be prescribed.

In general the following medicines are anti-herpetic:—antimony, mercury, sulphur alone, or connected with the other; *æthiops antimonialis*, *æthiops mineralis*, *calomel* with *sulphur auratum*, graphit (*a*), iodine, cod-liver oil; further, drinks operating on the skin and kidneys, especially if the secretion of urine be sparing or dropsical accumulations have been already produced; decoction of *dulcamara*, of various kinds of woods, the *ola tricolor*, *lign. juniperi*, *cortex mezerei*, *tinctura cantharidis*, and the like. If the skin be very much inflamed, flowers of sulphur, with cream of tartar and *guiaicum*.

791. The *external treatment*, which especially requires attention, and in all cases in which the herpes depends on internal causes, only after previous internal treatment, must be directed by the condition of the ulcers. If these be inflamed and painful, merely lukewarm water and mild salves or fomentations are to be employed. When the inflamma-

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(*a*) WEINHOLD, K. A., der Graphit, oder neuentdecktes Heilmittel wider die Flechten. Meissen, 1812. 8vo.

tion has diminished, sulphur baths, solution of sublimate, the phagedenic water, red or white precipitate ointment, flowers of sulphur, with fat or with soap and water, mercurial ointment, *unguentum citrinum*, *oxygenatum*, graphit salve, a solution of nitrate of silver, and the like are to be used; in old herpetic eruptions the douche with sulphur water, or a blister upon the part of the eruption to destroy it completely, which may be effected by often touching with nitrate of silver. Sulphur with soap and water made up into a liniment and a solution of sublimate I have found more effectual than all other remedies. In this treatment derivation with issues or setons and strict dietetic regimen is always necessary. If symptoms arise from metastasis of the herpes, it must be reproduced as quickly as possible. In habitual herpes, where frequently all remedies are employed in vain, bathing of the part on which the herpes is situated in a decoction of almond bran is very serviceable. In very deep-rooted and wide spread herpetic eruption, when the skin is much changed, the sublimate baths (*a*), the hunger-cure, and ZITTMANN's decoction are very efficient. In such cases, arsenic internally and externally is recommended. The *Herpes exedens* on the face is often alone cured by completely destroying the diseased part with caustic, and best by HELLMUND's remedy (*b*).

B.—OF SCALLED HEAD.

FRANK, J. P., Epitome de curandis hominum morbis, book iv. p. 87.

GALLOT, L. S., Dissert. sur la Teigne. Paris, 1802.

ALIBERT, above cited, first book.

792. Under the term *Scalled Head* (*Tinea* (*c*) *Capitis*, Lat.; *Kopfgrind*, Germ.; *Teigne*, Fr.) are included the ulcers situated in the skin of the hairy part of the head, covered with crusts of various thickness and colour and accompanied with a secretion of an often peculiarly smelling ichor. Previous to the formation of these ulcers, there occurs a more or less severe smarting, redness and often swelling on some part of the head not unfrequently accompanied with swelling of the glands in the neck and headache. These symptoms increase and then among the hairs are observed sometimes pustules or vesicles, surrounded with an inflamed edge, sometimes circumscribed, pea-shaped swellings, which are white and yellowish at their tip. When these burst an ichorous fluid pours out, mats the hair together, and when it dries forms crusts, beneath which the ichor collects, the skin is destroyed; considerable pain and swelling of the glands of the neck are produced; and usually many lice are generated.

793. According to the different forms of scalled head are distinguished:

1. *Tinea favosa.*—From the little pustules are produced by drying up of the matter contained in them yellowish crusts, often isolated and round, often by running together of considerable extent, with their centre indented, their edges raised, and accompanied with painful itching and secretion of ichor, having the smell of cat's urine. When of long standing all the ulcerated places are covered with thick white crusts, which stick fast, and the intervening skin is covered with branny scales. The ichor collects

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(*a*) v. WEDEKIND; in HUFELAND's Journal, 1822. August.

(*b*) RUST's Magazin, vol. xix. pt. i. p. 55.

(*c*) BATEMAN and the modern English writers prefer the genuine term *Porrigo* used by CELSUS to *Tinea* proposed by SAUVAGES.

between these crusts, and frequently destroys the skin even to the bone. Similar crusts are often formed on the face and other parts. If the crusts be removed, the skin is found inflamed, and a clammy fluid exudes from it.

2. *Tinea granulata.*—This is characterized by small, tubercular, irregular crusts, sometimes gray, sometimes grayish, without depression at their tip, usually situated on the upper hinder part of the head, surrounded with branlike scales, and accompanied with a nauseous secretion having the smell of rancid butter or putrid milk. These tubercles, not deeply penetrating in the skin, cause painful smarting, spread very rarely upon some parts of the face, but never on other parts.

3. *Tinea furfuracea.*—Upon the hairy part of the head are formed branny, whitish, more or less thick scales, which are sometimes quite dry, sometimes accompanied with a secretion of a filthy smelling, viscous fluid, and with painful itching. They spread frequently on the forehead, and eyebrows.

4. *Tinea asbestina.*—Commonly upon the fore and upper part of the head, scales are produced, silvery white, glossy, resembling asbestos, which mat the hair together, and cover its whole length, but are accompanied with little pain, and scarcely any secretion.

5. *Tinea muciflua.*—Pustules or little abscesses arise, pouring out when they burst a yellowish viscous fluid, which dries into whitish yellow crusts. A mucoid fluid, resembling spoiled honey, flows out in quantity and mats the hair together. These ulcerations generally spread over the whole face.

794. If the scalled head be of long continuance, or have been neglected, it often produces considerable destruction of the skin of the head, loss of the hair, disturbance of nutrition, suspension of the development of the body, diseased changes of the nails and the like. In *Tinea muciflua* there is often general falling away when the secretion diminishes, and the previous good health only returns when it reappears.

795. Scalled head occurs usually in children about ten years old; but the *Tinea muciflua* commonly shows itself during lactation. Scalled head, however, often also occurs later, especially *Tinea favosa*; but *Tinea asbestina* is peculiar to adults.

The proximate cause of scalled head is an inflammation of the skin, on which the diseased secretion depends, and by the drying up of the secreted fluid the crusts are produced. The occasional causes may be, in children the too great flow of blood to the head, too nourishing food, milk from a debauched, diseased wet nurse, uncleanliness, living in bad damp air, irritation of the head from lice, and its too warm covering; also scrofulous or syphilitic dyscrasies, and contagion, which, though not always, may under certain circumstances occur.

796. Scalled head is in many cases to be considered as a healthy discharge, and its sudden suppression dangerous. The difficulty of curing it depends on the variety of its causes. If it be easily removable, frequently a simple local treatment is sufficient for its cure; but if it depend on a scrofulous or syphilitic dyscrasy its cure is always difficult. It often first subsides at the period of puberty.

797. The *treatment* of scalled head is as various as its causes. The diet must, therefore, often be changed; attention paid to fresh air and exercise; special cleanliness observed; slightly aperient, diluent remedies, especially purifying the skin, and in scrofulous and syphilitic dyscrasies their antidotes are recommended.

798. The *local treatment* must lessen the irritation, loosen the crusts, and cleanse the sores. This must be effected by frequent washing of the head with softening decoctions, by rubbing in mild salves, fresh butter, sulphur-flowers and hog's lard, by softening poultices of mallows and hemlock. This treatment, with at the same time cleaning the head with combing, or cutting off the matted hair and removing the lice. If the ulcers be obstinate, sulphur ointment must be used, or a solution of sublimate employed. This local, with internal treatment, corresponding to the general state of the patient, and a properly regulated diet, has up to the present answered to my wishes in all cases. Other remedies that have been recommended are, solution of sublimate with verdigris, solution of liver of sulphur, decoction of tobacco, red and white precipitate ointment, *unguentum oxygenatum*, *ægyptiacum*, *citrinum*, solution of sulphate of potash with lime water, soap and spirits of wine, and so on. In very obstinate cases, according to ASTRUC and others, a plaster of gum ammoniacum and vinegar, thickly spread on leather, and applied for six or eight weeks, will effect the cure. The pulling out the hairs with forceps, or with strips of sticking plaster, is rarely, and only necessary when by their irritation they keep up the sore. The sudden tearing off of a pitch plaster, applied over the whole head, and therewith the sudden removal of the hair is objectionable. When the scalled head has continued a long while, artificial sores must be produced by mezereon, issues, and so on, before the cure can be effected.

C.—OF MILK-CRUST.

STRACK, C., De Crustâ lacteâ infantum, ejusdemque specifico remedio. Dissert. altera præm. ornat. Frft., 1779. 12mo.

WICHMANN's Ideen zur Diagnostik, vol. i. p. 43.

AUTENRIETH, Versuche für die praktische Heilkunde aus den klinischen Anstalten zu Tubingen, vol. i. pt. ii.

799. *Milk-crust* (*Crusta lactea*, *Tinea faciei*, Lat.; *Milchborke*, Germ.; *Croûte laiteuse*, Fr.) consists in smarting spreading ulcers, which arise from little vesicles on the cheeks, ears, forehead, or chin; these burst and pour out a yellowish fluid, which dries into white or yellowish crusts. The discharge from the ulceration is sometimes trifling, sometimes considerable. The eruption spreads gradually over the whole face, with which usually inflammation of the eyes is set up, even over part of the head, the neck, and other parts, and the child wastes in consequence of the continual restlessness.

When this eruption is more moist and eating, great smarting is produced from little blisters like pimples, slightly raised above the skin, and dusky, which soon spreading on the face and other parts, form dusky crusts; and the children, from their continual uneasiness, often waste, become feverish and miserable. The disease is, in this form, called *Crusta serpiginosa.*

800. *Crusta lactea* is generally a disease void of danger, and of indefinite duration, not unfrequently subsides of itself, (in which case the urine is turbid and smells like cat's urine,) and recedes without scarring. It occurs generally in infancy, but also in children from four to seven years of age, and even later. Its causes are too copious nourishment,

fulness of humours, (in which cases the disease is salutary, and its quick suppression may cause dangerous symptoms,) bad state of the chyle, teething, and scrofulous disposition.

Crusta serpiginosa is always consequent on a complication of *Crusta lactea*, with a syphilitic or herpetic disposition inherited from the parents, or imbibed by the child from its nurse. It is always a serious disease, may endure long, and produce dangerous symptoms.

Autenrieth, thinks that the itch lies at the bottom of the *Crusta serpiginosa*, and that the latter is an itch of sucking children. This opinion is, in general, unfounded; for itch in its perfect form is often found in sucking children, without *Crusta serpiginosa*, and the latter again may be found without any causal relation with itch.

801. The treatment of milk crust is local and general, and must be guided according to the cause. The food of the child must be changed, the state of the nurse's health improved by suitable remedies, another nurse obtained, or the child weaned if the latter be not possible.

If there be acidity in the *primæ viæ*, magnesia is to be given; and in scrofulous diseases the remedies antidotal to it. In slight cases this treatment often effects the cure; but if it be insufficient, pansy is to be given, either as decoction of half a drachm of the fresh plant, with milk, morning and evening; or half a drachm of the dried plant in powder, with milk, or mixed with pap. In obstinate cases, or in *Crusta serpiginosa*, the preparations of antimony, of sulphur, or mercury, may be used, cautiously, according to the age and constitution of the patient; as well also as other remedies which purify the skin. In the local treatment care is always necessary, in order not to suppress the secretion too quickly; but after long continuance it must be specially attended to. For loosening the scabs, cream, mild salves, oil, softening decoctions are to be used, and then washing with sublimate water. In great sensibility of the skin and spreading of the ulcers, an ointment composed of flowers of zinc, white precipitate, with olive oil and lime water, a solution of liver of sulphur, and the like. Sulphur baths, also, in these cases do good service.

von **Wedekind** (*a*) thinks the use of the *herba jaceæ* inefficient. Dabbing the sore twice a-day with sublimate water will always effect a cure, at the utmost in four weeks, without injuring the health. If swelling of the glands, and sores in the neck, remain after the eruption is completely gone, these parts must be carefully washed with sublimate water; but rarely is *æthiops antimonialis* necessary.

D.—OF THE ITCH.

Wichmann, J. E., Aëtiologie der Krätze. Hannover, 1791. 8vo. Second Edit.; with one copper plate.

Guldener von Lobes, E. V., Beobachtungen über die Krätze; gesammelt im Arbeitshause zu Prag. Prag., 1795. 8vo. Second Edit.

Hildebrand, Bemerkungen über den Krätzauschlag. Hannover, 1797. 8vo.

Galès, Essai sur le diagnostic de la Gale, sur ses causes, &c. Paris, 1812. 4to.

De Carro, J., Observations pratiques sur les Fumigations sulphureuses. Vienne, 1819. 8vo.

Galès, J. C., Mémoire, Rapports et Observations sur les Fumigations sulphureuses. Second Edit. Paris, 1824. 8vo.

(*a*) **Hufeland**'s Journal, 1822, August, p. 27.

Wenzel, K., Die wahre Krätze, mit besonderer Beruchsichtigung ihrer unrichtigen und unheilstiftenden Behandlungsarten als eine Quelle zahlloser fürchtbarer Nachkrankheiten. Bamberg, 1825. 8vo.

Cazenave, A. et **Schedel**, H. E., Abrégé pratique des Maladies de la Peau, d'après les auteurs les plus estimés et surtout d'après les documens puisés dans la Clinique de M. le Dr. **Biett**. Paris, 1828. 8vo.

Ackermann, J. C. G., Bemerkungen über die Kenntniss und Kur einiger Krankheiten, part v.

Vezin, Ueber die Krätze und ihre Behandlung. Osnabrüch, 1843. Second Edit.

802. The *Itch* (*Scabies*, *Psora*, Lat.; *Krätze*, Germ.; *Gale*, Fr.) consists in an eruption of vesicles which, sometimes small and millet-shaped, are filled with transparent fluid, sometimes are larger and filled with thick pus-like matter, somewhat inflamed at their circumference, and mostly at first occurring between the fingers, on the wrists, and on the joints; gradually they spread over the whole body, and burn and smart severely after the person is heated, or during the night. The vesicles either dry up and crust, (*Dry Itch*, *Scabies sicca*,) or they burn and pour out an acrid fluid which corrodes the parts (*Moist Itch*, *Scabies humida*.)

If the itch be neglected or suppressed, many vesicles often arise at one part, run together, burst and discharge an acrid ichor, which seizing on the neighbouring parts, considerable ulcers are often in consequence produced, which are covered with scabs; between these the acrid fluid penetrates; their edge is thick, and their circumference covered with itch-pustules (*Itch Ulcers*, *Ulcera scabiosa*.) The appearance of these ulcers, the previous existence of the itch, which has been quickly suppressed, or the still existing eruption, render the *diagnosis easy*.

[**Krause** (*a*) states that itch may exist in persons who wash themselves often, or who have very tough skins, without any eruption; the itching and the power of communication may be present, but no visible sign of the disorder may exist, except the burrows of the insect.]

803. The cause of itch is a contagious matter which can only produce the disease by immediate and somewhat long-continued contact of a person affected with the itch, or by substances, as clothes, bedding, and the like, infected with the contagion. The susceptibility for this contagion varies, but it is favoured by uncleanliness, living in bad air, bad food, and the like; from which circumstances itch is very common in workhouses, among the poor, in dirty hospitals, in certain businesses, and so on. As to the *itch-mite* found in the pus of the itch-pustule, and which some consider as the cause of the disease, others as secondarily developed in the itch-pustule, opinions are not yet alike, even after the careful inquiries of late made.

The so-called *False Itch* (*Scabies spuria*, *symptomatica*) indeed resembles the true disease in its appearance; it does not, however, usually first show itself between the fingers, does not smart so much in warmth, is not contagious, but may be so, and under certain circumstances runs into true itch. In most cases it seems to be a kind of herpes, arises particularly in great uncleanliness, in bad feeding, in living in bad air, after the suppression of the usual discharges in persons who have been subject from early years to stoppage in the bowels, scrofula, or gout, in spring time, and during recovery from inflammatory diseases. On the outbreak of itch other diseases often disappear (*Scabies critica*.)

(*a*) **Casper**'s Wochenschrift, July, 1840.—**Forbes**'s British and Foreign Medical Review, vol. x. p. 564.

The *itch-mite*, (*Acarus scarabæi*,) which, described formerly (1), and particularly by Wichmann (*a*), could not be found by others, (Bateman, Baker, Canton,) or has not been considered as the cause of itch, has, by the dispute between Alibert and Lugol, by Renucci's observations (*b*) confirming its existence, by the ingenious colonizing experiments which Albin Gras (*c*) instituted, and by the careful inquiries of Eble (*d*) and others, of late become of considerable importance, as thereby the earlier contradictory statements are put to rights. From Eble's observations especially, it results that the itch-mite is to be found neither in the lymph nor in the pus of an itch patient, and just as little within the vesicles or pustules; also never in *Scabies pustulosa*, but always in *Scabies vesicularis* alone, and even at that time only just prior to the formation of the vesicle and its being filled with serum. Eble in vain employed himself to find them elsewhere than between the fingers and on the wrist; they may, however, occur on other parts of the body. In perfectly round, well-defined and isolated vesicles the mite is sought in vain; but, on the contrary, it is seen in vesicles farther advanced, which are only well-rounded and defined on one side, but on the other side have a distinct, dark, grayish, yellow canal, from three-fourths to one line longer, perhaps one-fifth of a line wider, also filled with a little serum, at the opposite blind end of which is found a little wee body, somewhat darker than the rest of the cuticle. If this canal be slit up with a cataract-knife without injuring the dusky body, the mite, a drop of pale serum, usually escapes, and if the back of the cataract-knife be attempted to be brought under the mite, it may be raised and put upon a glass, where it may be ascertained with a simple but strongly magnifying lens, whether you have before you the mite or a piece of epidermis, or dried lymph; for it shows the trunk and very hairy feet which are usually in motion. Under the microscope may be examined all the peculiarities shown by the mite, as Wichmann had already given them, and the accurate engravings are only to be ascribed to the best microscopes (*e*).

The number of itch-mites has no direct proportion to the intensity of the disease; generally there are but few itch-mites on a person affected with the itch; a hundred may, however, exist on the hands of a patient who has but few vesicles (*f*).

Itch is produced only by the mite and not by the fluid of the pustule, and persons inoculated with pus from such pustules do not have the disease in consequence (Emery) (*g*). The itch-mite belongs to nocturnal animals, as it only wanders about at night, so contagion appears almost alone to be effected by *sleeping* with an itch patient (Aube) (*h*).

It is important as regards determining the inoculation of itch by transplanting the mite, that the mite can only be found in the itch which has not been treated with external remedies, although the itch continues; also that single itch-mites may be transferred, but no itch produced, whilst it appears after the translation of a large number (Gras.) The number of mites has also no proportion to the number of pustules; they are not found in the pustular form, although that is as contagious as the vesicular (*i*).

[(1) Our countryman, Thomas Mouffet, the author and editor of the *Theatrum Insectorum*, London, 1634, fol., says that Abinzoar or Avenzoar, a Spanish-Arabian Physician of Seville, who lived in the twelfth century, was the first who described the itch-mites as *acari*, little lice that creep under the skin of the hands, legs and feet, causing pustules full of fluid. He also quotes Joubert, who called them *sirones*, or mites concealed under the cuticle, beneath which they creep like moles, gnawing and causing a troblesome itching. But Mouffet himself saw them, and remarks that their habitation is not in the pustule, but near it; which statement was subsequently proved by Linnæus and Dr. Adams. And he also observes, that they cannot be lice as they live under the cuticle, which lice do not (*j*). Hyacinth Cestoni, at the latter end of the seventeenth century, made a careful examination of the itch-mite; an accouut of which is given by Bonomo in a letter to the celebrated entomologist, Redi (*k*).

(*a*) Aëtiologie der Krätze. Hannov., 1791. Second Edit.

(*b*) Gazette des Hôpitaux. Paris, 1834. Gazette Médicale. Paris, 1834.

(*c*) Recherches sur l'Acarus ou Sarcopte de la Gale de l'homme. Paris, 1834.

(*d*) Ueber die existenz der Krätzmilbe; in Jahrb. des östr. Staates. Neueste Folg, vol. ix. p. 3.

(*e*) Raspail, Mémoire comparatif sur l'Histoire Naturelle de l'Insecte de la Gale. Paris, 1834, 8vo. —Froriep's Atlas zu Hautkrankheiten, book v. pt. ii. Weimar, 1837.—Heiland, Dissert. de Acaro humans. Berol., 1836. 8vo.

(*f*) Gras; in Annales des Sciences Naturelles, vol. vi. p. 122.

(*g*) Behrend's Allgem. Répertor der ausl. Journaliste, Jan. 1835.—Köhler in Med. Vereinszeitung für Preussen. 1836. No. 9, 41.

(*h*) Considérations générales sur la Gale et l'Insect qui la produit. Paris, 1836.

(*i*) Pentzlin, upon *Scabies vera*; in von Graëfe und Walther's Journal, vol. xxiv. p. 176.

(*j*) Kirby and Spence, Introduction to Entomology, vol. i. p. 92.

(*k*) Observations sur les Cirons ou Insectes de la Peau des Galeux; in Collect. Académ. Etrangère de Paris, vol. iv. p. 574.

(2) It must not be overlooked that, in 1812, **Galès**, Apothecary to the Hôpital St. Louis (*a*), made some very extensive inquiries on the subject of itch, and examined with the microscope more than three hundred of these animals, taken from the itch vesicles, which were always of the same form, but had sometimes six, sometimes eight legs, depending, as he believed, on variety of development. He confined one of these mites with a watch-glass upon his hand, and observed it penetrating the cuticle; a few hours after which three vesicles appeared, and the intense itching left no doubt of the disease.]

804. The itch is sometimes more easy, sometimes more difficult to *cure*, but never dangerous under proper treatment. If it be neglected, especially with continued uncleanliness, it often changes its form considerably, so that there are fewer pustules than thick scurf, and various degenerations of the skin, often resembling *Lepra squamosa*, with considerable thickening of the skin and cellular tissue, and extensive ulceration, and as in protracted ulcers, (*par.* 749,) with the symptoms of long-continued general ailing, to wit, loss of appetite, weakness, hectic fever, swelling of the glands, and costiveness. If it be connected with other diseases, as scrofula, syphilis, scurvy, gout, rheumatism, and catarrh, it is always more obstinate and ill-conditioned. If suppressed quickly, asthma, inflammation of the lungs, consumption, dropsy, convulsions, blindness, diseases of the joints, and the like, may ensue.

805. In the *treatment* of itch, a *simple* and *complicated* form are distinguished. In simple itch, when in an otherwise healthy person it has existed for a longer or shorter time, it is always to be considered as a purely local complaint, and to be cured merely by local means. Complicated itch being in relation with the above-described general diseased conditions and dyscrasies, their treatment must be attended to.

806. Simple itch is cured by any remedy which destroys the itch-pustule and produces such inflammation in the skin that the cuticle mortifies and is thrown off. On this circumstance may be explained the great number of remedies and modes of treatment recommended for the itch, which only operates when in their composition they have such substances as bring about the above-mentioned effects, or are so energetically rubbed in that the *rubbing itself* produces the same result. Externally, frequent washing with soap and water is recommended, soap baths, frequent change of the washes, and the greatest cleanliness, flowers of sulphur with soap and water, or as a salve with fat, alone or in connexion with precipitate of mercury, white vitriol, extract of lead, with laurel berries, with muriate of ammonia, and the like. Also ointments of manganese, of white and black hellebore, *ung. oxygenatum*, washes of solutions of sublimate, of white vitriol and liver of sulphur, the sulphur fumigation highly valued by Galès and De Carro; the English mode of cure, in which the patient lies naked between blankets and has his whole body rubbed thrice a-day with an ounce of ointment of hog's lard, soap, sulphur, nitre, and hellebore, and is put into a lukewarm bath only at the beginning and end of the cure; and, lastly, the rubbing in of black or green soap.

807. Friction, however, with Horn's liniment and black soap is far preferable to all other modes of treatment. Both remedies are simple in their application, and cheap, and cleanliness can be easily preserved.

Greasy salves are of all the remedies against the itch the most filthy, partly because, especially if they have been long kept in store in the apothecaries' shops, they quickly dry up the itch and *metastasis* is produced; partly because their use is accompanied

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(*a*) Quoted at the head of the Article.

with much disagreeableness, and the observance of due cleanliness is scarcely possible. The wards of itch patients in hospitals where this mode of treatment is employed, give sufficient proof of this assertion.

808. The liniment recommended by Horn (*a*), composed of one part of flowers of sulphur, two parts of black soap, and as much water as necessary to make a liniment, is to be rubbed in four times a-day to the amount of four to six drachms, on all parts affected with the itch and so smartly that the patient may feel a burning sensation and the diseased skin may spring off; at the same time, also, warm baths and the greatest cleanliness possible.

The strenuous rubbing-in of this liniment, so that the above-mentioned symptoms may be excited, is in no case to be neglected, and therefore also in hospitals the friction is not to be left to the will of the patient, but is to be made under the observation of trustworthy attendants. I have, by attending to this circumstance, perfectly cured in a short time cases of inveterate itch which have withstood various kinds of treatment.

809. Fischer (*b*) has proposed the application of *smear soap* (black or green soap, *sapo viridis*) in the following way :—The patient, quite naked, smears his whole body, in the morning, with from two and a half to three ounces of green soap, then puts on a clean fresh shirt and goes to bed from which he is not to get up till the cure is completed, except to eat and to go to the night-stool ; in the evening the same quantity of ointment is to be rubbed in as in the morning. On the second and third days two complete rubbings, each of two ounces, of the whole body are to be made, as well where the pock and smarting are, as where they are not. On the fourth day or after the sixth rubbing, the friction is to be continued morning and evening but only on those parts where the eruption and smarting exist ; the same also on the fifth and sixth days ; and from the fourth to the sixth day no more than four ounces are to be used. On the seventh day, when no more of the eruption and itching are observable, the morning rubbing is to be carefully used, but in the afternoon a general soap bath (of smear soap and warm water) is to be resorted to, which concludes the cure and the patient is to be provided with clean linen and clothes. If after the soap baths a few pocks of itch still show themselves here and there, they must be anointed a day or two longer and the patient must then bathe again. In summer he may be at once set at liberty, but in winter requires a day or two's rest. During the cure no internal treatment is needed, his food must be simple, soup, pulse and meat; his drink water; the temperature of his room at all times of the year should be from 18° to 21° Réaumur [=about 72° to 81° Fahr.]

810. The symptoms which occur during this treatment are the following. Some hours after the first rubbing there is tension of the skin with slight burning ; gradually the burning becomes more severe and at the third or fourth rubbing so great, that the irritable patient declares he feels as if he lay in the fire. The third day is usually the most painful ; the skin is then not merely red and inflamed but elevated into little close-set watery blisters with which the itch pustules become confluent. On the fourth the redness for the most part still remains, the little vesicles become here and there larger, in many parts crack and the skin turns off in plates as in true smooth scarlet fever. The patient suffers in the night only a little smarting. Merely on those parts where the rubbing has been less severe and the inflammation of the skin together with the watery

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(*a*) Oeffentliche Rechenschaft über meine zwölfjahrige Dienstführung, u. s. w. Berlin, 1818, p. 164.

(*b*) Graf ; in Heidelberger klinisch. Annalen, vol. vii. p. 554.

blisters not completly developed, do the old itch pustules partially remain or re-appear. From the fifth to the sixth day, the inflammation, redness, and burning of the skin diminish, and the skin peels in such large masses, that parts of the body an inch broad and long become visible, covered with quite new and perfectly clean epidermis. The sleep is quiet and the patient feels himself comfortable. In the bath the cuticle comes off completely; the new skin is free from eruption and what still remains of the old skin is already destroyed and peels off the next day without further assistance.

Graf continues rubbing the skin with tallow made fluid every evening, for eight days, for the purpose of removing the tension which sometimes continues in the delicate young skin and to facilitate the scaling of still firmly attached old pieces of epidermis. In eruptions of many years standing, he first orders a purifying medicine of tartar emetic and sulphate of soda; and during the rubbing gives internally two doses of sulphur daily, and rubs in a day or two longer. In cases where, after some years, the itch still remains local, the soap alone is sufficient; but when the above-described general symptoms are present, suitable internal remedies must be employed. In seven days Graf (*a*) cured an elephantiasis spreading over the whole body.

For the reasons above described the efficiency of this mode of treatment may be judged of, and to it may be added some methods which have recently been recommended as especially efficient. Vézin's treatment, a lukewarm bath, in which the patient, standing, is to be rubbed over the whole body with warm water and black soap by means of a piece of coarse woollen stuff, with which care should be taken to rub off the existing itch-pustules and blisters. The patient is then, without further clothing, to be covered up in thick flannel and lie for twelve hours on a mattress provided with a pillow, and covered up, besides the cloak, with a woollen cloth. After the lapse of the appointed time he gives up his cloak and lying down, for the purpose of rubbing in, near the fire, a sufficient quantity of the following salve, *sulph. depur. subtillissime pulv.* ℥ j. *rad. helleb. alb. subl. pulv.* ʒij. *potass. nitr. subl. pulv. gr.* x. *sapon. nigr.* ℥j. *adip. suill.* ℥iij. M., over the whole body and especially on those parts affected with the eruption, after which he puts on his cloak and resumes his former position. After twelve hours, this rubbing is to be repeated, and again after another twelve hours. When the fourth twelve hours have passed, the second and last bath is to be used, in which he remains as long as in the first; and the cure is completed. During the cure care must be taken that the temperature of the sick-chamber should be kept up to 28°-30° Réaumur [=95° to 100° Fahr.] The patient should then put on clean linen and his previously disinfected clothes. Pentzlin (*b*) uses tar soap, composed of one part of good fat tar, two parts of old salt butter melted together over a charcoal fire, and one part of finely powdered potash shaken into it whilst being stirred; this the patient with the help of an assistant rubs over the whole body without overlooking a spot. After putting on a clean shirt the patient goes to bed and there continues at the second rubbing, which is to be done twenty-four hours after in a similar manner. After the first or second rubbing, the single pustules are observed to shrivel and form a flat smooth crust. Neither irritation nor inflammation of the skin is observed; the patient, however, complains of a disagreeable sensation principally depending on the somewhat sticky nature of the ointment. After the fourth, and at latest after the seventh rubbing all the pustules are seen to be changed into thin, smooth, brownish crusts; the rest of the skin appears smooth and natural. The patient must, however, have a purifying bath of 28° Réaumur [=95° Fahr.], and after remaining in it some time and careful rubbing, the whole body is, on leaving the bath, to be properly rubbed with green soap, and he is put to bed, where, by careful rubbing kept up with woollen cloths, everything attached to the skin is removed (*c*).

[In the Belgian army liquid sulphuret of lime is used for the cure of the itch according to the following order:—" Each patient is to be supplied with an ounce or an ounce and a half of liquid sulphuret of lime in a small pot. This quantity he is to rub carefully and slowly with his hands on every part that is covered with papulæ. If there be any papulæ on the back, another patient is to rub the liquid on that part. The operation is to be repeated three times in the twenty-four hours so that each patient consumes three or four ounces of the sulphuret daily. A bath is to be taken every alternate day; the frictions are to be suspended on that day. Fifteen frictions (or ten

(*a*) Above cited.

(*b*) Above cited.

(*c*) Dr. Serger, Vergleichende Versuche über die Behandlungsarten der Krätze nach Vézin, Fricke, und Pfeuffer; in Würtemb. Correspondenzblatt, 2839, July 29.

days' use) are usually sufficient for the cure of the disease, if the medical officer in charge sees that the remedy is properly used. *Preparation of the sulphuret of lime.*—Take of sublimed sulphur 16 lbs. and of quick lime 32 lbs. and boil in 80 lbs. of water for three quarters of an hour. Let the mixture rest for some time until it settle, and then let the clear fluid be decanted off. Boil the residue afresh in about the same quantity of water, treat it in a similar manner, and add this decoction to the first. Usually 140 lbs. of the sulphuret, at 12° by the areometer are thus obtained. If the liquid be more dense, it should be lowered to this standard by the addition of rain water (*a*).]

811. In Complicated Itch the local treatment must be preceded by, or accompanied with the internal remedies in part already mentioned, sulphur alone, or with antimony, purgatives, woody drinks, and the like. If the itch by its long continuance have very much weakened the patient, or if a scrofulous, syphilitic, scorbutic, gouty, or rheumatic dyscrasy exist, the proper remedies for them must be employed.

812. Itch ulcers may be bathed with sublimate water, *aqua phagedenica*, in addition to sulphur ointment, or any of the above-mentioned salves. If these ulcers be of long continuance, it is advisable to establish issues before stopping them up, which in a very old itch is especially not to be neglected.

813. If the itch be quickly suppressed, we must endeavour to restore the eruption by blisters, by rubbing of tartar emetic ointment, washing and rubbing the skin with irritating remedies, and even by inoculating the itch; at the same time also external remedies acting on the skin, especially sulphur and antimony, must be used.

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(*a*) Braithwaite's Retrospect of Practical Medicine and Surgery, vol. x. p. 115.

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814. *Venereal Ulcers*, *Chancres*, (*Ulcera Venerea*, *Syphilitica*, Lat.; *Schanker*, Germ.; *Chancres*, Fr.,) are distinguished as *primary* and *secondary* (1); the former are consequent on the inoculation of venereal poison and occur at the place of infection; the latter are symptoms of general infection of the body (2).

[(1) The terms *venereal ulcers*, *chancres*, here used indiscriminately by **Chelius** in reference to both primary and secondary sores, are incorrect. All the sores which result from impure connexion are venereal, in the common acceptation, but all venereal sores are not chancres; therefore to name them chancres produces an erroneous impression of their nature, and should be avoided. The employment of the title, chancre, to sores whether primary or secondary is also improper, for although the primary sore, to which alone English Surgeons, following the authority of **John Hunter** restrict the name, chancre, may infect the constitution and cause secondary sores and other symptoms, which, together, are by him designated *lues venerea*, yet the matter from a secondary sore will not produce chancre, as proved by **Hunter**'s experiment of inoculating a man who had venereal blotches with matter from his own sores, and also with chancrous matter, in which case the former wounds healed up, but the latter became chancres. It is therefore preferable to give the name *syphilis* to the whole series of symptoms resulting from the communication of the poison of the Hunterian chancre, which is the primary manifestation of the disease, as the ulcers in the throat, the eruptions and sores on the skin, and affections of the bones are the secondary or constitutional results.

(2) **John Hunter** says:—“The venereal poison is capable of affecting the human body in two different ways; *locally*, that is in those parts only to which it is first applied and *constitutionally*, that is in consequence of the absorption of the venereal pus which affects parts while diffused in the circulation. * * * The local or first kind is what I have called *immediate*, arising immediately upon the application of venereal pus. Of this kind there are two sorts seemingly different from one another. In the first there is a formation of matter without a breach in the solids, called a *gonorrhœa*. In the second there is a breach in the solids called a chancre. Neither of these two ways in

which the disease shows itself is owing to anything peculiar in the kind of poison applied, but to the difference in the parts contaminated." (p. 24.)

"The most important feature in the natural history of syphilis is," says **Lawrence**, "the progress of the complaint from one part of the body to another; the succession of symptoms it shows in successive organs and textures; the frequent renewal of the disease in the same organs, or textures, after it has apparently ceased. Some forms of the disease are attended with considerable suffering, great local suffering and considerable constitutional disturbance. When we find that these symptoms are capable of showing themselves, from time to time, in different parts; when we find the disease come on again and again in the same part; when we find that those affections require, as they frequently do, the employment of vigorous and active means of treatment, which exert powerful influences on the animal economy, we cannot wonder that the constitution is frequently enfeebled by the disease, and that in some cases, patients ultimately sink under it. In this point of view, the nature of syphilis is sufficiently serious, though not so serious as formerly supposed." (p. 723–24.)]

815. The operation of the venereal contagion pre-supposes a peculiar delicate structure of the part or a deprivation of its cuticle. Primary syphilitic sores therefore usually arise on the *glans*, and on the prepuce, on the buttocks, on the nipples, on the lips and tongue, according as the infection has occurred from connexion, from suckling children, from kissing, and the like.

816. From two to four days, sometimes longer, sometimes shorter (1), after the communication of the venereal poison in an impure connexion, there appears on some part of the *glans* or prepuce in men, and on the *labia* or *nymphæ* in women, a red inflamed spot, accompanied with a smarting sensation, and usually in men with frequent erection; this rises to a little vesicle filled with pale fluid, which after sometime breaks and leaves behind a superficial excoriation; or a hard painful lump arises, which bursting forms a painful ulcer. These ulcerated spots enlarge, have more or less hard everted edges, surrounded with an inflamed edge, and having a foul lardaceous bottom; or they are often covered with scurf, are often very eating, or have everted but not hard edges. They spread more quickly or more slowly in breadth and depth, are more or less painful and inflamed, become sometimes even sloughy, cause considerable destruction, and often even bleeding (2).

The pus secreted by venereal ulcers, is sometimes thin, sometimes of more consistent nature, of a yellowish-white or yellowish-green colour, and makes on white linen, spots like half-melted tallow. Its quantity is always more considerable than from the size of the ulcer might be expected. After healing, scars remain, which have the same size as the previous ulcers.

[(1) **John Hunter** says:—"I have known cases where the chancres have appeared twenty-four hours after the application of the matter, and I have known them seven weeks. * * * An officer in the army had a chancre break out upon him two months after he had had any connexion with a woman." (p. 232.)

Ricord, in addition to this, observes that "experience has shown him that on the third day of inoculation the pus of chancre became contagious and sometimes even on the second." (p. 540.)

(2) "This like most other inflammations which terminate in ulcers, begins, says **John Hunter**, "first with an itching in the part; if it is the *glans* that is inflamed, generally a small pimple appears full of matter, without much hardness, or seeming inflammation, and with very little tumefaction, the glans not being so readily tumified from inflammation as many parts are, especially the prepuce; nor are the chancres attended with so much pain or inconvenience as those on the prepuce; but if upon the *frænum*, and more especially the prepuce, an inflammation more considerable than the former soon follows, or at least the effects of the inflammation are more extensive and visible. Those parts being composed of very loose cellular membrane, afford a ready

passage for the extravasated juices; continued sympathy also more readily takes place in them. The itching is gradually changed to pain; the surface of the prepuce is in some cases excoriated, and afterwards ulcerates; in others a small pimple or abscess appears, as on the *glans*, which forms an ulcer. A thickening of the part comes on, which at first and while of the true venereal kind, is very circumscribed, not diffusing itself gradually and imperceptibly into the surrounding parts but terminating rather abruptly. Its base is hard and the edges a little prominent. When it begins on the *frænum* or near it, that part is very commonly wholly destroyed, or a hole is often ulcerated through it. * * * The original excoriation or wound may heal although contaminated, and afterwards become a chancre. (p. 233.)

LAWRENCE observes, that "generally speaking, the process of ulceration in a syphilitic sore is not very rapid; it is rather a chronic kind of ulceration, though there is considerable difference in the various kinds of sores which belong to this disease. Usually speaking, the syphilitic sore is of a circular figure, but not necessarily so. The sores which are produced by the application of venereal poison to the external organs of generation are various in their appearance. We cannot describe one particular character of sore, as the result of venereal poison. We find that there are several, all of them seeming to be equally produced by that cause, and yet differing materially from each other in their characters." He divides these sores into five kinds: 1st, the simple venereal sore, (*venerea vulgaris* of EVANS,) a superficial ulceration, taking place very commonly on the internal surface of the prepuce. Usually there is more than one; generally a sore upon the *corona glandis*, frequently two, three, or four of them, in that situation just behind the prepuce; or such a number may form around the orifice of the prepuce itself. In the first place there is a degree of excoriation from ulcerative absorption; after a certain time the excoriation thus produced is filled up, so that the sore becomes again level with the rest of the surface, the continuation of the reproductive process goes on, and produces an excess of substance in that particular part, so that it projects above the surrounding surface and then the part cicatrizes. These are the stages this sore goes through, and it will often occupy four, five or six weeks in proceeding through the different stages. It is also very painful, and commonly the surface bleeds when the dressings are changed and the part is exposed. * * * 2nd, A venereal sore in which the margin of the ulceration is elevated, and a little indurated; * * * there is a roundish kind of margin; the surface of the sore itself has something in it of a peculiar character, and the discharge from it is scanty in quantity; it bursts and forms a thin scab. 3rd, The *indurated chancre*, that is, a venereal ulceration taking place on an indurated basis, so that the margins of the sore and the basis on which it is formed present an unnatural hardness." This is HUNTER's chancre, but LAWRENCE does not agree with his views in reference to the hardened base and edges being essential to the character of a true syphilitic sore. "4th, The *phagadenic primary* sore, presenting the removal of a part by ulcerative absorption; the part has a sharp edge, is sometimes undermined, and the surface is irregular and ragged; there is an eating away, as the term implies, of the textures of the part; there is no formation of granulations; there is nothing like an attempt at the reproductive process, and there is a thin ichorous and very offensive discharge from the sore. Sometimes this phagedenic ulceration extends slowly on the prepuce or *glans*, and greatly destroying those parts; at other times it goes on with much more rapidity; the surface of the sore assumes a livid appearance; there is an ichorous discharge; the ulcerative process goes on, and it frequently destroys the whole of the organ. 5th, The *sloughing* or *gangrenous chancre*, where there is a loss of vitality, and the surface of the sore assumes a dark, black, and manifestly a sloughy appearance. The surrounding parts are highly inflamed in this case; there is considerable redness, swelling, and acute pain; there is also loss of vitality, and the ulcerative surface of the part that has sloughed is separated, and a fresh slough forms over the part; thus the sore becomes rapidly larger and it spreads in every direction, until the part is destroyed by that kind of process constituting sloughing phagedena. * * * This sloughing change is found to take place under two different circumstances. We very commonly see it as the result of neglect and intemperance, in the cases of sores that may not have been sloughy originally, and where persons having primary syphilitic sores take none of the precautions to get rid of them, but continue their occupations and go on with their intemperate habits, causing a high degree of inflammation to be superinduced upon a complaint which is of itself originally of an inflammatory nature; but in other cases the sloughy state is observed from the very first; there is a high degree of constitutional disturbance under this form of change; there is a full and hard pulse, more particularly when it occurs in young robust persons; a white tongue, and in fact the general symptoms that characterize high inflammatory fever." (p. 765-66.)]

817. The pus of the ulcer is the special vehicle of the venereal contagion, the proximate nature of which is unknown, but by its absorption the general *Venereal Disease* or *Pox* (*Syphilis universalis*, *Lues Venerea*, Lat.; *Lutseuche*, Germ.; *Vèrole*, Fr.) is produced, which is manifested by various signs.

[John Hunter's assertion that the matter produced in *gonorrhœa* and chancre is of the same kind, and that the only difference is that the one proceeds from a a secreting and the other from a non-secreting surface, having been already discussed. (pp. 163, 64,) and clearly refuted by the observations of Benjamin Bell, Hernandez, Ricord, and others, does not require further discussion, as it is now universally held that they are two distinct and independent diseases.—J. F. S.

Various experiments have been made as to the effects of inoculating matter from patients labouring under *gonorrhœa*, or chancre, from sores on the genitals, supposed to be syphilitic, and from secondary sores on other parts of the body. Some of these were instituted by Hunter with a view to determine the identity of the poison of *gonorrhœa* and chancre, which he considered he proved, though this opinion is now generally held to be erroneous; and also to ascertain whether the matter from primary and secondary sores was the same. But we are indebted to Ricord for having proposed inoculation for the purpose of distinguishing syphilitic sores, whether primary or secondary, from doubtful sores, the situation and character of which might at first lead to the notion of their syphilitic nature, although in reality quite free from that disorder. The following are the very interesting and important observations he has made on this subject:—

" All the natural or morbid secretions of individuals reputed to be syphilitic have been examined by means of inoculation, and one single form has furnished constant results, and that form is, the primitive ulcer, otherwise called chancre. The chancre, which is to the constitutional pox what the bite of the mad dog is to hydrophobia, does not produce always a specific pus, but at one certain epoch of its existence, and it is certainly from not having appreciated this so simple fact, that the results of inoculation have been contested or appeared doubtful. It is very evident that the primitive syphilitic ulcer cannot be the same at all its periods, and that it cannot arrive at scarring, if it do not at least pass to the state of a simple ulcer, by the destruction of the cause which tended to keep it up; but we must not require from these different phases, similar characters, corresponding results; it is in the period of progress or of the *statu quo* of the ulceration, whilst there is no attempt to scar, that the chancre secretes the *venereal poison.*

" The specific nature of the chancre is neither grounded in the organ actually ailing, nor in the vitality or functions and sympathetic reactions of this organ, nor yet in relation with the greater or less degree of inflammation which may accompany the ulceration. Its seat has so little influence on the special nature of the chancre, that that disease cannot be regarded, without error, as peculiar to the generative organs. In reality, there is no part of the skin which cannot become its seat; no spot, in the requisite condition, and can be voluntarily fixed on, is safe from it; developed on other regions, than the generative organs, it still preserves all its characters without any exception. Thus the chancre of the tip of the finger, of the thigh, of the tongue, of the foot, (if it be not modified,) furnishes pus, inoculable, and capable of producing another chancre *without the participation of the generative organs; whilst no other alteration of these organs is capable of re-producing a chancre, whatever may be its form, its extent, and the degree of the accompanying inflammation.* * * * This fact then is established by experiment, and may the mere speculations of the closet dispute it? The chancre, whatever its seat, is the consequence of a specific pus, which it alone secretes, and which, as has been so well named *true leven, peculiar ferment, (véritable levain, ferment spécial,)* reproduces an identical disease wherever it is fitly deposited.

" But this particular leven, which has no specific action but when it determines an ulceration, is produced *only during that period of the chancre, which then almost makes, if the expression be permitted, an accidental virulent organ.* In reality, as we have seen, the chancre has two very distinct phases; the first, to which the name still belongs, is that of growing or stationary ulceration, it is that which furnishes the peculiar pus; the second is, that of reparation, which only takes place by its passing to the state of simple ulceration, permitting the scarring or transformation on the spot, and furnishing no more specific virulent secretion. It may be imagined how important the distinction between these two periods of chancre is; for without it every thing is confusion, and the same ulceration which inoculated a few days before no longer giving contagious pus. We must decide on the uncertainty of the experiments, where on the contrary they are of great value.

"But if we take some of the secreted matter of a chancre, at the period we have pointed out, and convey it with a lancet beneath the epidermis, see what happens; in the first twenty-four hours, the puncture, as in cow-pox, reddens; on the second or third day, it swells a little, and presents the appearance of a little papule encircled by a red areola; on the third or fourth day, the epidermis, raised by a liquid more or less turbid, takes on a form, often vesicular, presenting on its tip a black point, resulting from the dying of the blood of the little puncture; on the fourth or fifth day, the morbid secretion increases, becomes purulent, the pustular form is decided, and its depressed tone gives it the navel-like appearance which allies it to the pustule of small-pox. At this period the areola of which the extent and intensity had increased begins to subside or diminish, especially if the disease have not made progress; but after the fifth day, the subjacent tissues, which often have not yet been affected, or have been only slightly œdematous, infiltrate and harden by the pouring out of a plastic lymph which is resistant to the touch, and has the elastic feel of certain cartilages; at last, usually after the sixth day, the pus thickens, the pustule wrinkles, and crusts soon begin to form. If these be not detached, they enlarge at their base, and rising by stratified layers, assume the form of a truncated cone with depressed top. If the crusts be detached, or drop off, an ulcer is found below, seated on a hard base, presenting a ground of which the depth is represented by the whole thickness of the skin, and of which the surface, white, more or less deeply tinged with gray, is formed by a lardaceous, sometimes by a pultaceous matter, or even by a false membrane which cannot be detached by wiping. The edges of the ulcer at this time sharply cut as by a circular punch, are, however, undermined to a greater or less extent, and present under a lens slight indentations and a surface similar to that of the ground; their edge, the seat of a gorging and hardening corresponding to that of the base, presents a kind of ring of a reddish-brown colour, more or less tinged with violet, and which, more prominent than the neighbouring parts, so raises the edges by turning them a little out, as at first gives a funnel-shaped appearance to these ulcerations." (p. 85–90.)]

818. *Swellings of the Glands* (*Bubones*) *in the neighbourhood of the ulcers*, are in many cases to be considered as the first symptoms of general syphilis. They are caused by absorption of the venereal poison (*idiopathic buboes*); but they may also be the consequence of a consensual irritation attacking them (*sympathetic buboes.*) They appear mostly in the glands of the groins, whilst the primary ulcer still remains on the generative organs, and usually when the inflammation in the ulcers is not very great, the ulcer not making progress or even after it has healed. The patient first feels a tension and pressure in the groin, and a hard painful swelling of one or several glands appears which may be pushed about beneath the skin, or is attached to it. The swelling increases, the skin over it reddens, the pain becomes constant, and febrile symptoms are not unfrequently set up. The bubo may disperse, but if the pain be severe and throbbing, its passage to suppuration is certain, when the swelling softens at its top, the skin bursts, and an ulcer is produced, with hard everted edges, and its foul bottom often beset with granulations. Burrowing of pus and considerable destruction frequently take place. Buboes may even in a very high degree of inflammation and under dangerous internal and external influences run into gangrene.

["The true venereal bubo, in consequence of a chancre, is," says John Hunter, "most commonly confined to one gland. It keeps nearly its specific distance till suppuration has taken place, and then becomes more diffused. It is rapid in its progress from inflammation to suppuration and ulceration. The suppuration is commonly large for the size of the gland, and but one abscess. The pain is very acute. The colour of the skin where the inflammation attacks is florid red." (p. 285.)

Ricord has ascertained by inoculation that buboes are of seven kinds:—1st, The bubo may be simply inflammatory; *a*, by propagation of the inflammation, without reference to the particular nature of the primary cause of its production, whether a clap, a chancre, or every other lesion; *b*, by sympathetic reflection. 2nd, It may be virulent, that is, dependent on the direct absorption of the specific matter of the syphilis, and then it is the strict consequence of chancre, the pus of which can alone produce it. 3rd, It may be superficial or deep, or may appear in both forms. 4th, It may have its seat in the cellular tissue, in the lymphatic vessels or ganglions, separately or conjointly. 5th, It may be acute or chronic. 6th, It may be preceded by the other symptoms called primary, or it may appear at once. 7th, When other symptoms have appeared before it, it may either follow them immediately, and then be only a successive symptom, or it may present itself at the period of the general symptoms of the pox, and constitute secondary bubo. * * * * Whenever an inflammation of the cellular tissue or of the lymphatic system of the inguino-crural or other regions has been consequent on any other cause than chancre, and suppuration has been the consequence, no result has been obtained by inoculation, whatever have been the period and the conditions under which the pus has been taken. Thence, for instance, when a clap has preceded the bubo, and suppuration has occurred, no inoculable pus is obtained; it is only when preceded by a chancre that a specific pus capable of inoculation is furnished. But it is not sufficient that a chancre should have preceded the bubo, for the latter of necessity to furnish a specific pus; for that purpose the bubo must be neither the result of a simple sympathetic or successive inflammation, but there must have been absorption; but absorption, when it occurs after a chancre of the generative organs, affects only the *superficial ganglions*, and most commonly only one at a time, although more ganglions, either superficial or deep, may be inflamed or swollen at the same time, so that one ganglion actually presents all the characters of a virulent bubo, whilst the neighbouring ones, in which the inflammation has reached to suppuration, as well as the surrounding cellular tissue, present simple and not virulent characters. I was some time before I could well make out these conditions and explain why all the buboes would not inoculate, as those who had repeated my experiments without well knowing them, had asserted; and how it happened that a bubo of which the pus would not inoculate one day would do so on the following; or why in a bubo with separate centres, and which might be called multilocular, one centre furnished inoculable pus and the other did not. I then set about being more exact in my experiments, and first inoculated all buboes, immediately on opening them, with the first pus that escaped, and the result was negative, which explained M. CULLERIER'S statement, who had perhaps only experimented under these circumstances, or with simple buboes. I then, at two, three, four, five days and more, after opening, took some pus from these same buboes, and then the pus exhibited in many instances positive results, and in others the inoculation continued to produce nothing. In the former case the centre, as well as the edges of the opening, delayed not to take on the characters of chancre, whilst in the latter the abscess followed the course of simple phlegmonous or lymphatic abscess to its cure. An important question then remained for decision, whether in the case where the pus of the bubo had not inoculated at the instant of the opening, it had not acquired its inoculable quality by contact with the air, or by the external mixture, after opening with the pus of a pre-existing chancre, or in some other manner. The solution appeared very difficult, when a patient came to me with a bubo following a chancre, and with large suppuration. I opened the abscess, but after having discharged the pus from the cellular tissue, I found in the middle of its centre a very large lymphatic gland fluctuating in its centre. This I opened, and with the pus it contained made an inoculation, and at the same time a similar one with pus from the neighbouring parts, that is, from the cellular tissue; and whilst the pus from the ganglion produced the characteristic pustule, that from the cellular tissue produced nothing. * * * The same results were obtained by pus from the course of the lymphatic vessels. * * * But as to the deep ganglionic swellings called deep buboes, when they suppurate, which is much more rarely than the superficial, the pus furnished from them never inoculates, unless in a purulent , they are found after the cut bathed in the pus of a neighbouring chancre or by an infected superficial ganglion; but never in this case are the deep ganglions infected by absorption." (p. 62–6; Fr. edit., p. 138–146.)

Upon the question of the existence of syphilitic buboes, without primary sore, HUNTER speaks with caution. He says, indeed, "the first and most simple mode (of absorption) is where the matter either of a *gonorrhœa* or chancre has only been applied to some sound surface without having produced any local effect on the part, but has been absorbed immediately upon its application." But almost immediately after he observes:— "It must be allowed that this mode of absorption is very rare; and if we were to examine the parts very carefully, or inquire of the patient very strictly, probably a small chancre might be discovered to have been the cause, which I have more than once seen." Another concludes, "there is, however, no great reason why it should not happen" (p. 274.) From these observations it is quite clear that HUNTER's mind was not satisfied upon this point.

RICORD has also inquired into this subject, and observes:—"If, however, it be true that after suspicious sexual connexion, the enlargements of the neighbouring ganglions of the generative organs become rarely primarily affected, there are, however, circumstances in which it is impossible to find any suspicious antecedent or concomitant, and then we are forced to admit a primary bubo (*bubo d'emblée.*) When these enlargements are carefully examined without our being led into error by those which may resemble them, we find that they most commonly appear in the deep ganglions, and as frequently, even in those of the iliac *fossa*, or at least in the sub-aponeurotic ones of the thigh; that their course is often chronic; that they are long indolent, and have little disposition to suppurate; but it is very remarkable, that when they do suppurate, the pus they produce will not inoculate: never as yet have I found a bubo embracing all the positive signs of an immediate bubo which produced inoculable pus. If to this important observation be added, that after the exact researches which I have made, I have never found that immediate buboes, in the strict sense of the word, have been followed by general symptoms of pox, the importance of inoculation in this case will be evident." Hence he concludes, that "a virulent bubo, or that from the absorption of the pus of chancre, is a symptom in every respect analogous to chancre as to its nature, and only differs in its seat; that virulent bubo is the only one which will inoculate; that the signs indicated by authors for distinguishing virulent bubo from the enlargements with which they are confounded, without exception, in the greater number of cases, serve only to establish a rational or probable *diagnosis*, and that inoculation alone can be considered as the indisputable and pathognomic sign; and that if in a greater number of cases the precise *diagnosis* of a bubo were not absolutely necessary to direct the treatment and to form a *prognosis* of the coming chances to the patient, when there is question of a *bubo being immediate*, we should never neglect when suppuration has taken place, to examine it at every stage of its course, careful examination, close observation having proved that buboes which do not inoculate (when the experiments are properly made) are never followed by secondary symptoms, and that they also are not syphilitic; whilst from other causes which often escape us, and without needing the pox, may give rise to enlargements of the lymphatic system of one region of the body as well as another; and that it would therefore be absurd to conclude that a bubo is necessarily syphilitic because it had appeared a short time after connexion." (p. 67-9; Fr. Edit., p. 148-51.)]

819. If the disease be general, it attacks especially either the *skin*, *mucous membranes*, or *bones*. The length of time from the origin of the local syphilitic symptoms to the outbreak of the general venereal disease is different. Usually it occurs six weeks after the primary syphilitic affection; a longer as well as a shorter space of time may, however, be observed. The attack of the *masked syphilis* (*lues larvata*) can only be properly applied to this period, when, with a seeming cure of the primitive syphilitic affection, up to the outbreak of the general disease, no decided symptoms are manifest. The appearance of the general syphilis is mostly accompanied with slight fever and with burning heat in the palms of the hands.

["The venereal matter," observes JOHN HUNTER, "when taken into the constitution produces an irritation which is capable of being continued independent of a continuance of absorption; and the constitution has no power of relief; therefore a *lues venerea* continues to increase. This circumstance is perhaps one of the best distinguishing marks of the *lues venerea*; for in its ulcers and blotches, it is often imitated by other diseases which, not having this property, will therefore heal and break out again in some other part; diseases in which this happens show themselves not to be venereal; however, we are not to conclude because they do not heal of themselves, and give way only to mercury, that therefore they are venereal, although this circumstance, joined to others, gives a strong presumption of their being such." (p. 320.)]

820. *An Inflammation in the Mucous Membrane of the Throat* most commonly shows itself as a seeming catarrhal affection, with stoppage in the nose, difficulty in swallowing, hoarseness, snuffling speech, and tears in the eyes. On internal examination of the throat, the mucous membrane

is found reddened, the tonsils and *uvula* swollen; the redness, specially fixed on certain spots, is on others pale and discoloured. These places break up and run into ulcers, which are sufficiently characterized by their peculiar appearance. Vesicles often arise on the inside of the cheeks or at the corners of the mouth, which sometimes run into ulcers. These sores spread quickly, destroy the pendulous palate, attack the bones of the nose, produce a stinking secretion from it, (*Ozæna syphilitica,*) *caries,* and destruction of the nose-bones.

821. On the external skin syphilis appears as *blotches,* (*Maculæ,* Lat.; *Flecken,* Germ.; *Taches,* Fr.,) *vesicles,* (*Vesiculæ,* Lat.; *Blätterchen,* Germ; *Vésicules,* Fr.,) or *pustules,* (*Pustulæ,* Lat.; *Pusteln,* Germ.; *Pustules,* Fr.,) which are especially common on the face and forehead, (*corona Veneris,*) and at first have a pale but subsequently a copper-coloured redness. The pustules are surrounded with a reddish brown edge, are sometimes single, sometimes collected in groups; they often produce considerable burning, especially at night, and frequently run into ulcers which have purple edges, and secrete an ill-conditioned ichor; they usually increase only in breadth, though often in depth, and even attack the bones. If pustules occur on hairy parts, the hairs fall off; if beneath the nails, these fall off also, or are loosened by the ulcers, and the fresh growing nail is misshapen. These pustules often appear in form of small boils, which do not suppurate, but merely trickle.

[LAWRENCE describes four forms of cutaneous syphilitic eruptions: "1st, The scaly eruption is one of the most common. The skin before the eruption appears exhibits a kind of mottled or marbled appearance all over the body. If you strip the patient, though the skin is seen in the natural state, yet there is a streaked or mottled appearance underneath; there are little patches of red appearing through the cuticle, which give it that appearance. Very soon you observe spots of a reddish brown, or what would be called a coppery colour on the skin; and this has always been the marked character of venereal eruption. These reddish-brown superficial discolorations of the skin soon become more deeply coloured. The cuticle covering them desquamates a little, becomes scaly, and the cuticle separates. The spots increase in size; they often run together, so that you have considerable patches of the skin in various parts of the body assuming this colour. In the end these discolorations generally are large in size and particularly vivid. They have a bright coppery-red colour, and the cuticle over them becomes very scaly. They are very strongly marked when they occur in the palms of the hands and soles of the feet; then the contrast of the colour of the diseased with the healthy skin is very strong; and the cuticle being thick, cracks and assumes a whitish appearance, and what would have come under the description of that which WILLAN and BATEMAN call *syphilitic lepra* or *syphilitic psoriasis.* 2nd. Very frequently syphilitic eruption exhibits itself in the tubercular form. In the scaly form just mentioned, the discoloration is superficial, and the coppery red spots do not rise above the level of the surrounding sound skin, but in the tubercular eruption you have a small kind of eruption with the point more raised, and as that proceeds, the cuticle goes into the scaly state, so that that is in fact a scaly eruption, although there is a tubercular elevation of the cuticle in the first instance. 3rd. In other cases there is a more acute action of the skin—active inflammation, with the formation of inflamed pimples, or of *papulæ,* as they are technically termed. These arise in clusters and patches in various parts of the body; after remaining for a time, they vesicate and suppurate, and that suppuration dries up, and they go into a scaly state, and you have a succession of those pimples forming over various parts of the body; this is called papular venereal eruption. 4th. There is another form in which you see it, where pustules, that is, inflammation of the skin, takes place, effusion occurs, and the cuticle is elevated into inflamed pustules; these proceed and form venereal ulcers, that is, the pustular venereal eruption. These are the principal forms of eruption, observed as secondary symptoms of syphilis; a scaly eruption which may be called *syphilitic lepra* or *syphilitic psoriasis,* a tubercular eruption, a papular eruption, and a pustular eruption proceeding to ulceration. Now you do not find these eruptions always distinct; frequently they are so, but sometimes the different characters of the eruptions are united; that is, you will find an eruption partly pustular and partly scaly. * * * The pustular eruption spreads into ulcerations; the cuticle, which has been elevated by lymph or pus, gives way, and the fluid which is discharged incrusts upon the surface. The skin ulcerates under that incrustation; a greater discharge of matter takes place, and the incrustation is increased. If the parts be kept moist, an ulcer is seen; but if less exposed to the air, the matter concretes, and the part is covered with incrustations more or less thick. The ulcerations thus formed are superficial sores, generally of a circular shape and rapidly healing. In other instances they degenerate into very foul and intractable ulcerations of a phagedenic character. Very generally they retain the circular form and heal up in the centre but not towards the edges; there is a healing up in the centre and a very foul or tawny margin by which the ulceration extends. Frequently the sores are of a crescent shape, that is, they have a convex edge by which they extend, whilst they heal up at the concavity. Sometimes the phagedenic edge is simply of a tawny colour; at other times it is considerably elevated and almost sloughy, with a very red, angry, and fiery state of the neighbouring skin. There is a considerable variety in the characters of these syphilitic ulcerations of the skin, all of which originate, in the first instance, from a vesicle or pustule." (pp. 773, 74.)]

822. Syphilis often produces on the skin a more herpes-like eruption, which exfoliates like scales, especially in the hollows of the hands, (*Rhagades*,) on the thighs, in the neighbourhood of the generative organs, on the buttocks. The skin also frequently has cracks, with copper-coloured, callous, painful edges, from which an ill-coloured acrid fluid is poured out. Or there arise, most commonly on the generative organs and the rump, *Growths*, which, according to their different form and consistence, have various names, as *Warts*, (*Verrucæ*,) *Fig Warts*, (*Condylomata*, *Fici*, *Mariscæ*, &c.,) with which are frequently connected ulcers on the generative organs, discharge of *mucus* from the *urethra*, *vagina*, and so on (*a*).

[John Hunter first noticed the difference between the pus from a primary and that from a secondary syphilitic sore, and not admitting that though mercury cure both kinds, both were necessarily the same in their nature, "as mercury cures many diseases besides the venereal. On the other hand there are many strong reasons for believing that the matter is not venereal. There is one curious fact which shows it is either not venereal, or if it be, that it is not capable of acting in some respects on the same body, or on the same state of constitution, as that matter does which is produced from chancre or *gonorrhœa*. The pus from these latter, when absorbed generally, produces a bubo, but we never find a bubo from the absorption of matter from a pocky sore; for instance, where there is a venereal ulcer in the throat, we have not buboes in the glands of the neck; when there are venereal sores on the arms, or even suppurating nodes on the ulna, there are no swellings of the glands of the arm-pit; although such will take place if fresh venereal matter is applied to a common sore on the arm, hand, or fingers. No swelling takes place in the glands of the groin from either nodes or blotches on the legs and thighs. It may be supposed that there is no absorption going on from such sores; but I think we have no grounds for such supposition. Its mode of irritation, or the action of the parts affected, is very different from what happens in chancre, *gonorrhœa*, or bubo, being hardly attended with inflammation, which in them is generally violent." (p. 512.) He then mentions some experiments made with the matter of secondary syphilitic sores on the skin, and on the tonsils, but from neither was any chancrous sore produced.

The truth of Hunter's opinions and observations on this interesting question has been of late fully confirmed by the experiments of Ricord, who says that he has thus arrived at the conclusion "that all reputed secondary phenomena are far from being specific; that infection by the venereal virus may excite in the economy disorders, lesions, the development of morbid symptoms analogous to those produced by any non-specific cause; but that independent of these, perhaps most common symptoms, and which afford a deceptive support to the doctrine of non-specificity of pox, or of the

(*a*) Albers, Ueber die Erkentniss und Heilung der syphilitischen Hautkrankheiten. Bonn, 1832.

Humbert, Manuel pratique des Maladies de la Peau appellées Syphilides. Paris, 1833.

Martins, Mémoires sur les causes générales des Syphilides (extr. de la Révue Médicale, vol. i. 1838.) Paris, 1838.

non-existence of the virus, there are certain regular characteristic symptoms occurring as necessary and sure consequences after the primary infection, and which are the result of chancre, under one of the forms already mentioned, or the product of inheritance, which military Surgeons can only deny from want of a proper field of observation. When we have followed the pus of a chancre, in its penetration into the economy, if I may be so allowed to express it, we have seen that whether it was merely by imbibition of the cellular tissue, to whatever depth it might reach, it still preserved its characteristic property, the capability of inoculating: that it was the same with the afferent lymphatics, from the chancre to the first ganglion, in which they terminated, and that beyond this point, where first began the mixture with the circulation and other organic matters by this kind of ganglionary digestion, which takes place in the lymphatic system, the pus underwent a transformation which, without depriving it of its specificity as regards the symptoms it produces in the economy, takes from it the power of inoculating: that it was only by virtue of this modification that this *syphilitic temperament* could be established, to give place more slowly to the diathesis for the development of secondary symptoms: that without traversing the lymphatic system this result was the strict consequence of venous absorption; the symptoms of constitutional pox not requiring for their manifestation, the passage of the virus by the lymphatics and the previous production, in all cases, of buboes." And hence he arrives at the conclusions, "*First*, That though one symptom does not inoculate, it is not therefore to be said that it is not syphilitic, because the virus modified by venous absorption and susceptible of poisoning the economy, loses this property whilst it preserves alone that of propagating by inheritance. *Secondly*, That whenever a symptom, whatever its seat and apparent form, inoculates, it is necessarily the product of direct contagion and not the result of general infection depending on absorption from one to another part, and does not actually indicate the *venereal temperament* or in common terms constitutional pox." (p. 74–7; Fr. Edit., p. 162–67.)]

823. The *Syphilitic Affection of the Bony System* is manifested by nightly pains, which are boring and gnawing, and situated, especially in tubular bones, and in such bones as are covered with least soft parts, as the shin-, arm-, breast-, collar-, and skull-bones. These bones, especially those of the shin and skull, swell up, in which latter case the bony swellings usually precede or are accompanied with severe head-ache. The bony swellings are often soft, and formed by a jelly-like mass poured out beneath the *periosteum*, (*Gummata*,) often hard and immovable, (*Nodi*, *Tophi*, *Exostoses*,) and frequently contain a chalky substance. Not unfrequently the bones swell very considerably; inflammation often takes place, and expansion of the medullary cavity of the tubular bones, (*Spina ventosa.*) If these bony swellings inflame and run on to ulceration, dangerous eating away of the bone (*Caries syphilitica*, Lat.; *Knochenfrass*, Germ.) occurs. But commonly by the destruction of the soft parts and of the *periosteum* the bones are laid bare to a great extent, killed, (*Necrosis*,) and thrown off in larger or smaller pieces (*Exfoliates.*) Very frequently also in general *Lues* inflammation of the joints and its consequences take place.

824. If the *Lues* have advanced considerably, hectic fever, complete disorder of the digestion, exhaustion, and death, may be produced by the tormenting pain, and by the great loss of the juices from the suppurating parts.

825. Syphilitic symptoms are subject to various modifications, which do not depend on a *variety* of the syphilitic poison, but on the constitution and age of the patient, on the mode of its reception into the body, on climate and other circumstances, on the existence of other diseases, but perhaps also on a qualitative change of the poison, which it suffers in insufficient treatment. The stronger and more powerful the person is, so much the more speedy in its course and destructive is the syphilis. In warm climates the general symptoms of syphilis are milder, it attacks rather the skin and its processes and the cellular tissue; in cold climates,

on the contrary, it attacks rather the bony system; in warm climates, however, there may be noticed great severity of the primary symptoms, in which case severe inflammation follows, and runs into mortification. This disposition to erysipelatous inflammation and mortification in primary syphilitic ulcers is observed frequently in bad, tainted, and marshy air. The scurvy, or a similar affection, after too frequent use of mercury, scrofula, gout, and rheumatic affections, may produce different variations of syphilis from its usual course, and thereby render *diagnosis* difficult.

Primary syphilitic ulcers have especially no decided external character; they have a very varied appearance, and cannot, at a mere glance, be distinguished from such ulcers as are of a more common or totally different nature.

["It cannot, I think, on due consideration of the subject, be denied," says ABERNETHY (*a*), "that many sores are induced on the genitals, by sexual intercourse, which are not the effects of the venereal poison, and that many of them infect the constitution, and produce secondary symptoms resembling those of that disorder. It may be asked, however, if these diseases be not venereal, what are they? As they are all the consequence of sexual intercourse, they may, in one sense of the word, be said to be venereal. To avoid ambiguity, therefore, I shall denominate that disease which broke out at the siege at Naples, and which Mr. HUNTER has described as the venereal disease by the name given to it by nosological writers, that is, syphilis; and I shall call those diseases, which differ from it in their progress and mode of becoming well, though they strikingly resemble it in appearance, by a name importing these circumstances, that is, pseudo-syphilitic diseases." (pp. 2, 3.) He then proceeds to some observations on the probable origin of the latter complaints, and mentions that "CELSUS describes eight species of sores with which the genitals were affected in consequence of sexual intercourse; and as this was long before syphilis was known, it follows that there must be other causes producing them. Some of the sores described by CELSUS are not unfrequently met with at present, and they are not syphilitic. Sores also frequently form upon the genitals of females, in consequence of that irritation which accompanies diseased secretions from the *vagina*. Sores, for instance, very frequently succeed to *gonorrhœa* in the lower class of females, who pay little attention to cleanliness, and do not abstain from sexual intercourse. Sores frequently break out on the prepuce and *glans* of the male, in consequence of the irritation which *gonorrhœa*, or other diseases of the *urethra* produce in these parts. These sores generally heal without mercury, frequently without inducing any constitutional disease; and when they do affect the constitution, the disease occasioned by them is not syphilitic. I merely mention these circumstances at present to show that it is possible for ulcers to form which may not be syphilitic, and yet the discharges from them may prove morbific, and produce disease in others. Even discharges from the genitals of one person, where no ulcers exist, are capable of exciting ulcers in another." (pp. 4, 5.) He further observes, that "the primary infected sores, which are capable of producing secondary symptoms, strikingly resembling those of syphilis, do not themselves possess any uniform characters" (p. 40). And he thinks "it is probable that the morbific poisons which produce pseudo-syphilis, may be absorbed without any evident ulcer, or from a trivial ulcer, which may heal spontaneously, much more frequently than the syphilitic poison." (p. 41.)

As regards the mode of distinguishing the false from the true disease, ABERNETHY says:—"I have not been able to discover any (appropriate characters); the fictitious dissease, in appearance, so exactly resembles syphilis, that no observation, however acute, seems to be capable of deciding upon its nature. Although the ulcers in these ambiguous cases generally spread more extensively along the surface of the part which they affect, yet this does not constantly happen. * * * It must also be remarked that true syphilitic spots and ulcers sometimes assume the appearance of other diseases, and do not possess their ordinary characteristics. Since then our senses fail us in our endeavours to discriminate between these two diseases, and since the most important circumstance is to distinguish whether the disease be syphilis or not, we may inquire whether there are any circumstances in the progress of these different diseases which will serve us in distinguishing one from the other. It appears to me that there are. * * * A very simple fact has enabled me in most cases to distinguish between the two diseases; yet simple as it is, if it be generally true, it is very important; and if it were universally true, it would be of the highest consequence. The fact alluded to is that *the constitu-*

tional symptoms of syphilis are progressive, and never disappear unless medicine be employed. It may be added too, they are as generally relieved under an adequate effect of mercury on the constitution." (p. 45–7.)

Abernethy further remarks, that "Mr. Hunter thought that syphilitic poison might produce a sore which might be modified by the diseased propensities of the constitution and the part, and thus lose its distinctive characters." And further:—"If, according to the opinion of Mr. Hunter, the action of a syphilitic chancre may be so modified by the diseased propensities of the constitution or part, as to form an ulcer scarcely cognizable as a syphilitic one, it follows, &c." (p. 59, 60.) Where this opinion of Hunter's is to be found, I know not, for I cannot meet with it in his work on the Venereal Disease; and the only passage at all like it is the following:—"Chancres, as well as the *gonorrhœa*, are perhaps seldom or never wholly venereal, but are varied by certain peculiarities of the constitution at the time." (p. 242). It must not, however, be omitted, that the last part of his work is occupied with observations "of diseases resembling the *lues venerea*, which have been mistaken for it," and that he closes his book with the observation "that undescribed diseases resembling the venereal are very numerous, and that what I have said is rather to be considered as hints for others to prosecute this inquiry further, than as a complete account of the subject"

Carmichael objects to the use of "those common but arbitrary terms syphilitic, syphiloidal and pseudo-syphilitic" (p. 48) diseases, which he regards as "an endeavour to conceal our ignorance by the adoption of plausible and delusive epithets and appellations." (p. 47.) And remarks, that "as long as syphilis is the name attached to a certain form of venereal complaints, we shall never escape from the terms pseudo-syphilis, syphiloidal symptoms, and *sequelæ* of syphilis. The first is an arbitrary term applied to a congeries of symptoms upon the nature and extent of which scarcely two practitioners are agreed; and, therefore, when one person calls a complaint syphilitic, another disease altogether different may be presented to the mind of the person he addresses. Pseudo-syphilis is equally objectionable, as it is too general a term for any useful purpose, inasmuch as it embraces not only all those venereal complaints which do not correspond to Hunter's description of syphilis, but all those spontaneous disorders which have no pretension to a venereal origin, and are solely attributable to some derangement of the constitution. The term syphiloidal symptoms and *sequelæ* of syphilis imply that there is but one venereal poison, an opinion which I conceive to be absolutely refuted." (p. 66.)

Without, as seems to me, any very satisfactory reason, Carmichael founds his arrangement of venereal complaints on the character of the eruption. He says:—"In arranging under distinct heads the numerous appearances and symptoms produced by venereal complaints, I would follow the same rule which has hitherto guided the judgment of the profession in arranging and classifying all other morbid poisons attended with eruptions. In other words, I would regard the eruption as the most proper basis of the arrangement; and, without neglecting such auxiliary evidence as other attending symptoms may afford, consider them as of minor importance in determining the nature of the disease. By following this method, it is truly gratifying to find how easily the numerous symptoms, both primary and constitutional, of venereal diseases, which are so various as seemingly to bid defiance to any attempt at arrangement, can be disposed of in their appropriate places under the name of the eruption which belongs to their respective species. Next to the eruption the symptom most to be regarded is the primary ulcer, whose characteristics are in general found sufficiently distinct to enable us to foretel with tolerable certainty what the appearance of the eruption will be." (pp. 62, 3.) Now, if such be the fact, as it most undoubtedly is, there does not seem good cause for taking the eruption, which is the second, and indeed not unfrequently the third form of the disease, and which frequently never appears at all, as the foundation of the arrangement of diseases which commonly do not, if properly tended, proceed beyond the primary sore, of which sore Carmichael says, "the characteristics are in general found sufficiently distinct," which sore must always have occurred prior to the appearance of the eruption, and is the condition of the peculiar eruption, although not necessarily followed by the outbreak of any eruption, as indeed Carmichael admits:—"On a loose computation, it may be regarded that nine out of ten of primary ulcers are not attended by constitutional symptoms; so that in a great majority of cases the disease has never arrived at the stage to which it is indebted for its name. To this objection I reply, that the primary ulcers afford a less decisive means of determining the nature of the disease than the secondary; yet from their characters when unaltered by irritation or mercury, we may discriminate their nature with sufficient certainty to decide on the precise eruption they would produce in their secondary state."

(p. 68.) These observations, on his own showing, seem to prove the needlessness of having recourse to the eruption as a nomenclator for his "division of venereal complaints into four distinct diseases;" but, as if to put the question beyond dispute, he immediately proceeds to give the following brief description of the several ulcers and their consequent eruptions:—*First*, the ulcer without callosity, raised edges, or phagedena, in fact without any very peculiar characters, and which may therefore be termed the *simple venereal primary ulcer*, produces the *papular* eruption, which *ends* in desquamation; and the same effect is produced by a patchy excoriation of the *glans* and *prepuce* in men and of the *labia* and *vagina* in women, and also by a *gonorrhœa virulenta*. *Second*, the ulcer with raised edges produces the *pustules* which terminate in small ulcers covered with *thin* crusts, and which *heal from their margins*. *Third*, the phagedenic and sloughing ulcers produce the spots and tubercles which terminate in ulcers covered with *thick* crusts, which are accompanied with *phagedena*, and *heal in general from their centre*. *Fourth* and lastly, the primary callous ulcer or chancre is attended with the well known *scaly eruption—lepra* or *psoriasis*." (pp. 68, 9.) Carmichael thus shows the grounds on which he had founded his opinion, that "the difference which was found to exist in the appearance and progress of certain groups of symptoms which usually went together, compelled him to presume the existence of a plurality of venereal poisons." (p. 48.) But subsequently he observes:—"If any individual object to the division of venereal complaints into four distinct diseases, the difference between us is easily reconciled. Instead of four distinct diseases, let any one that pleases consider them as so many forms or modifications of the one disease, each requiring a peculiar mode of management, and under this view every practical object will be equally well obtained." (p. 69.)

The following excellent observations of Ricord, whilst explaining the causes on which the varied appearances of chancre or primary syphilitic sore depend, at the same time negatives the much-disputed question of the plurality of venereal poisons, of which Carmichael is the great supporter.

"Chancre," says Ricord, "the strict and inevitable consequence of the application of the syphilitic poison, either upon the skin or mucous membranes, in the condition requisite for inoculation, often presents such varieties, in its material aspect, that it then seems to constitute different diseases. These differences of chancre, badly understood or ill-appreciated, have afforded to some an argument against the identity of the venereal poison and its unity of action, and to others, the proof of the existence of a plurality of poison; but, if well studied in its cause, which always remains the same in its mode of development, and its consequences, in the ordinary and not complicated cases, the seeming differences are explained with ease, and all contradictions disappear; for whatever be the actual form of the chancre from whence the pus has been taken, provided it have reached that period which I have pointed out, a regular and characteristic pustule is, as I have said and proved, obtained, when the virulent pus is put beneath the epidermis or epithelium, a direct ulcer (*ulcère d'emblée*), when it is applied on naked tissues, or an abscess, when it is introduced into the cellular tissue, into a lymphatic or into a ganglion, always bearing in mind the difference arising from the seat and particular tissues affected, there is found in the ulcer, at its commencement, a regular and peculiar physiognomy, and that also whether it be consequence of the rupture of a pustule, of the opening of a virulent abscess of the cellular tissue or lymphatic passages, or whether it have been produced direct. The deviations or special forms neither occur nor are developed, but after and under the influence of condition foreign to the specific cause, such as the peculiar constitution of the patient, his previous or concomitant ailments, his health, the general or local treatment to which he has been subjected. Thus is it that persons are affected with phagedenic chancres, who have contracted their malady from persons who, seemingly, had only benignant ulcers, and that this vulgar notion, participated in by some physicians, who conceive that a severe disease had been contracted from a very foul person, is found absolutely false." (pp. 60, 61; Fr. Edit. p. 134–36.)]

Ingenious as are these distinctions, yet are they by no means confirmed by experience; besides the circumstances already mentioned, on which the modifications of syphilis depend, there is still especially the proved fact against the admission of various syphilitic contagions, that frequently many persons are infected in different ways by one and the same person. But the principal ground of this (Abernethy's division) that the syphilitic affection is cured only with mercury, but the pseudo-syphilitic without it, has, on the contrary, lost all weight, inasmuch as it is perfectly well known that all syphilitic ulcers may be healed without mercury.

If it may also to this be added, that as the result of congress of the sexes, affections may occur on the generative organs, wherein, by examination, no perceptible disease of the generative organs is observed in the person from whom the disease arises; that, farther, as consequences of constitutional ailments, ulcers and other affections may appear which resemble syphilis, so this does not disprove the above stated opinions, and we must herewith not forget how frequently the patient purposely deceives the medical attendant, and that especially all the circumstances which come into play in contagion are still not sufficiently clear, as the existence of primary bubo, without previous affection of the generative organs, which, however, cannot be denied, proves the explanation of syphilis from simple irritation without contagion (*a*) is a mere crazy systematic fancy (*b*).

826. The same differences observed in primary are noticed also in secondary syphilis. Experience indeed seems to show that after venereal *gonorrhœa* and after superficial exfoliation a vesicular eruption, inflammation and wound of the throat, and inflammation of the synovial membranes take place. After primary ulcers with everted edges without hardness, a pustular eruption, whitish ulcers on different parts of the palate, pains in the joints and gummatous swellings; afterwards eating and scurfy ulcers, tubercular growths on the skin, pustules, ulcers in the throat extending to the nose and destroying its bones, pains in the joints and *tophi*. After ulcers with lardaceous bottom and everted, hard, callous edges, a vesicular eruption which scales, deep, hollow ulcers in the tonsils, pains in and swellings of the bones. These relations between the primary and consecutive affections are not throughout constant; often is one kind of primary affection followed in the same patient by an eruption of entirely different kind, which may occur either at the same time on different parts of the body or may break out one after the other.

On these grounds I consider the admission of a *gonorrhœal contagion*, as proposed by RITTER (*c*), to be untenable.

827. In the *prognosis* of syphilis the following circumstances are to be observed:—

Primary ulcers are more easily healed than secondary. The connexion of syphilis with other dyscrasies renders the cure difficult and may even make it impossible. The more recent is the disease, the more favourable is the *prognosis*. Syphilitic affections of the bones are more difficult to be subdued than those of the skin: those of the nose-bones are liable to more frequent relapses than those of the tubular bones. In warm climates and in summer the cure is more easy than in cold climates and in winter. Pregnant women in an advanced state of syphilis miscarry or bring forth a weak, ailing child. The ulcers in the throat and in the nose often easily produce extremely disfiguring destruction. All syphilitic growths are obstinate and easily recur. If, after the cure of primary syphilitic ulcers, hard scabs (*Tubercula callosa*) remain, a relapse is always feared.

[So does not think JOHN HUNTER, for he observes:—"The *gonorrhœa* in its cure is the most uncertain of the three (forms of disease,) the chancre next, and the *lues venerea* the most certain, although cured by the same medicine which cures the chancre. * * * A chancre may sometimes be cured in two weeks, and often requires as many months, which is in the proportion of four to one. The *lues venerea* in general may be cured in one or two months, which is only two to one." (p. 353.)

"In the cure of chancres I have sometimes seen," he says further, "when the original

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(*a*) RICHOND; in FRORIEP's Annalen, vol. viii. No. 17.

(*b*) EVANS, Pathological and practical Remarks on Ulceration of the Genital Organs. London, 1819. 8vo.

GUTHRIE, Observations on the Treatment of Syphilis without Mercury; in Med.-Chir. Trans. vol. viii.

WEDEMEYER, Bemerkungen über die Syphilis und ihrer verschiedenen Formen und über die Wirkungen und den Gebrauch des Quecksilbers in Derselben; in RUST's Magazin, vol. ix. p. 195.

(*c*) Above cited.

chancre has been doing well, and probably nearly cured, that new ones have broken out upon the prepuce, near to the first, and have put on all the appearance of a chancre; but such I have always treated as not venereal. They may be similar to some consequences of chancre which will be taken notice of hereafter." (p. 259.)

"Chancres," ABERNETHY observes, "do sometimes heal spontaneously, generally, however, though not constantly, leaving a thickening or induration of the part affected. They may also be induced to heal by topical means, without mercury, with similar events. Some enlargements of glands in the groin will also, in like manner, subside. It may be fairly supposed that if some chancres heal spontaneously, constitutional diseases, arising from the same cause, may, in like manner, sometimes get well without mercury. The question can only be solved by experience. Delay will, I am sure, frequently enable a Surgeon to decide that the disease is not syphilis; but there are cases in which no amendment takes place, and the Surgeon is, as it were, forced, from the progress of the disease, to employ mercury, though doubtful of its nature." (pp. 48, 9.)

"It often happens," says JOHN HUNTER, "that after chancres are healed and all the virus is gone, the cicatrices ulcerate again and break out in the form of chancres. Although this is most common in the seat of the former chancres, yet it is not always confined to them, for sores often break out in other parts of the prepuce; but still they appear to be a consequence of a venereal complaint having been there, as they seldom attack those who never had *gonorrhœa* or chancres. They often have so much the appearance of chancres that I am persuaded many are treated as venereal that are really not such; they differ from a chancre in general by not spreading so fast nor so far: they are not so painful nor so mūch inflamed, and have not those hard bases that the venereal sores have nor do they produce buboes; yet a malignant kind of them, when they attack a bad constitution, may be taken for a mild kind of chancre, or a chancre in a good constitution. I have seen several that have puzzled me extremely. Some stress is to be laid upon the account that the patient gives of himself; but when there is any doubt, a little time will clear it up. I have seen the same appearances after a *gonorrhœa*, but that more rarely happens. It would appear that the venereal poison could leave a disposition for ulceration of a different kind from what is peculiar to itself. I knew one case where they broke out regularly every two months, exactly to a day." (p. 265.)]

828. The opinions as to the treatment of syphilis are very much divided and may be arranged in two classes:—

1. *The treatment with mercury.*
2. *The treatment without mercury.*

1.—OF THE TREATMENT OF SYPHILIS WITH MERCURY.

829. In the cure of the primary syphilitic ulcer the most especial indication is to prevent the general venereal disease; it is therefore advisable to connect a general treatment to that effect with a suitable local treatment.

830. The *local treatment* has for its object the destruction of the syphilitic poison in the ulcer, the cleansing of its surface, and by a continued use of proper remedies to effect a cure. This is aimed at by touching the ulcers with nitrate of silver or caustic potash, most effectually with a saturated solution of mercury in nitric acid, or with a strong solution of sublimate. The ulcer should be frequently washed during the day with a weak solution of sublimate, or with phagedenic water and charpie moistened in either of these fluids applied over the ulcer; or it should be bound up with red or white precipitate, with citron ointment, and so on, and carefully kept clean. This treatment must always be guided by the degree of inflammation; in severe inflammation and great pain soothing remedies must be applied.

The destruction of the ulcer with nitrate of silver which has of late found in RICORD a zealous advocate, is only of use when the disease is still merely local, a period of time which is extremely short and difficult to determine.

831. At the same time should be given internally the milder preparations of mercury, the *mercurius solubilis* of HAHNEMANN, or calomel, at a quarter or half a grain, and in increasing doses according to circum-

stances. The patient during this mercurial cure must keep himself as quiet as possible and in an equal temperature, must live moderately, take neither heating nor acid food nor drink, and further perspiration by a decoction of woods.

["I should state decidedly" says **Lawrence**, "as the result of my own experience that there are very few instances of secondary symptoms occurring where the primary sores of the descriptions I have already mentioned, were treated with mercury. It is my plan in private practice, to employ mercury moderately—not extensively, but moderately—in the treatment of primary syphilitic sores, (excepting in the cases of sloughing and phagedenic sores,) and certainly I have been in the habit of seeing secondary symptoms very seldom occurring in such cases. * * * I would state then that in the description of sores I have mentioned, I should generally administer mercury in a moderate way. In the first instance, one would clear out the alimentary canal of such patients; one would keep them as quiet as possible, put them on a moderate diet, and administer mercury moderately; three, four, or five grains of the blue pill two or three times a day, and apply the black wash, calomel, and lime water, to the sores; and this kind of treatment is certainly, on the average, very successful in the cases of which I am now speaking. The employment of mercury is more particularly necessary in the cases of indurated chancre; and whether the chancre possesses that character originally, or whether the induration comes on subsequently, or whether the induration comes in a secondary way, after the primary sore is healed, and shows itself simply as induration without sore, I think the employment of mercury is equally required. We cannot consider our patients safe so long as such induration remains, and I think it is desirable to use mercury in those cases, and to continue the employment of it until the induration has completely disappeared." (p. 770–71.)

With regard to the extent to which the use of mercury should be pushed, **Lawrence** proposes two very pertinent questions, to which he gives equally good replies,—*First*, whether a slight degree of action of mercury on the mouth may be considered a proof that it has produced all the effect necessary for the removal of the venereal disease; or, *secondly*, whether a more considerable effect is necessary generally, or in particular cases? It has been much the habit, in modern times, to produce a sensible effect on the mouth, and then to discontinue the mercury, under a notion that when the mouth is affected at all, the system has experienced a sufficient influence for the removal of the disease. I cannot coincide with this opinion. In a great number of instances a slight effect of mercury on the mouth is sufficient; but there are instances in which that slight effect does not remove the symptoms, and which, when the remedy is carried further, so as to produce more considerable influence, the symptoms give way. In fact, I think we never see the symptoms of syphilis yield so rapidly, and so favourably, as in certain cases, where the remedy, perhaps, without our wishing it, has produced a pretty profuse salivation. Under these circumstances we may notice a sudden and rapid amelioration of the symptoms, which we are not in the habit of seeing when the mouth is affected in a slighter degree only. Another question immediately connected with the same point is, how long the remedy should be continued? Is it sufficient to destroy the venereal character of a sore and to produce the healthy process of restoration? Would you leave it off then and leave the cicatrization to form of itself? May you discontinue the use of the mercury the moment the cicatrization is complete, or should you try to secure the patient from the occurrence of secondary symptoms, by proceeding with the employment of the remedy after that? These are important questions, and we have not, perhaps, the means of answering them satisfactorily. With respect to the first, however, it is certainly not safe to discontinue the use of the mercury before the sore is cicatrized all over. Then, secondly, is any good produced by continuing the use of the mercury after the cicatrization is complete, with a view of preventing a return of the symptoms? This is a very important question, and if you refer to the best writers on the subject you will find but little to assist you. * * * General experience, however, has led to a belief that perseverance in the use of mercury for some time, say about ten days or a fortnight after cicatrization, has a beneficial effect in protecting the constitution; so that persons when they have used mercury to the extent I had mentioned, are not in the habit of suddenly discontinuing it, but of carrying it on for a short time after the apparent removal of the disease, under belief that its continuance tends to prevent the recurrence of further evil." (p. 732.)

"There are many in the present day," observes **Green** (*a*), "who seem to have a great aversion to mercury, and certainly if our opinion is to be formed from the prac-

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(*a*) Unpublished Clinical Lecture on the Treatment of Syphilis.

tice which was adopted by some, within my recollection, and even to a degree within these hospitals, there is no doubt very sufficient ground for not following the practice of our predecessors. But it would be evidently most injudicious to reject the aid of mercury in the cure of the venereal disease on the ground of the ill effects that may result from its mismanagement, or have been produced by its abuse. We now see the error of the older Surgeons, and do not think it necessary that patients should spit saliva by the pint, nor do we see them in what were fitly enough, from their stench and ill ventilation, called the 'foul wards' of the hospital, with their tongues ulcerated, swollen, and protruded, their faces tumified, and under all the miseries attendant upon a thorough salivation. We give mercury now in moderate quantities, and it is, I believe, from this improved method of treatment that we now see comparatively few cases of horrible mutilations from sloughing of the *penis*, from losses of the palate and nose, and from extensive and destructive disease of the bones. Mercury may no doubt be regarded as a specific in the cure of the venereal disease. What this peculiar action of mercury consists in it is impossible to say, and it is equally obscure with the effects of other specific remedies; but we judge of its operation from its sensible effects, and experience guides us in determining the quantity of the remedy which may be necessary, and the degree of effect which may be requisite for the cure of the disease; mercury, in short, requires the same caution and judgment in its administration as any other remedy. And although, as I said before, a much milder course than was formerly exhibited may be sufficient to cure the disease, yet it will be necessary to adopt it in particular cases, and to vary the mode of using it in different stages of the complaint, or you may have some of the ill effects which were formerly observed, and the patient's health may be destroyed without curing the disease. The advantage and benefit of mercury are not then derived from the quantity introduced or from the violence of its effects, but from keeping up a regular and continued action for a certain period. In general the action of mercury should be kept up three weeks for a chancre, a month where the primary sore has been succeeded by bubo, and from six weeks to two months in cases of secondary symptoms; and if the symptoms should disappear quickly, still it will be right that the remedy should be continued, for the mercury is not given to cure the local symptoms only, but to ensure the system against their recurrence, and to destroy the disposition to disease in those parts which have been contaminated by the poison.

"Something may be said too with respect to the form of giving mercury. Where you wish to continue it for a length of time you should give the mild form; where you wish to affect the system quickly, those kinds should be exhibited which are calculated to operate more rapidly. Hence it is not an unimportant matter whether we should give calomel, blue pill, *hydrarg. c. cretâ*, or the oxy-muriate of mercury. What we ordinarily employ in private practice is the blue pill; but in the hospital we commonly use mercurial friction. Mercurial friction can be very thoroughly effected in the hospital; but in private practice it is seldom effectually accomplished, as it is troublesome, dirty, and leads to the exposure of the complaint, and, therefore, except in peculiar irritability of the bowels, is seldom adopted. Five or ten grains of blue pill twice a day, with the addition of opium if the bowels should be irritable, will very commonly be sufficient to cure any complaint similar to that which we have been considering, in short, any secondary form of the disease; but then it must be a sustained course of mercury, its influence must be kept up on the system for six weeks or two months, or even for a longer period when the bones have been effected. It is necessary not so much to be guided by time as by the disappearance of the symptoms; and it is right to continue the effect of the mercury somewhat longer, a week, ten days, or a fortnight after the symptoms have subsided.

"But you will ask me what proof you are to have of the system being sufficiently influenced by the mercury, and how you are to know that its action is kept up without prejudice to the patient? During the mercurial treatment we ought to be satisfied that it has a due effect, and we commonly look for this in the affection of the gums, which become spongy, swollen, red, and tender. An increased flow of saliva is the usual accompaniment of this state of the gums, and the term ptyalism is often used as an equivalent term for the requisite influence of the mercury on the system; but the increase of the saliva is not at all a necessary consequence of the affection of the system, and is no proof in itself of the efficacy of the remedy; indeed, in some persons it does not take place at all, although there is abundant proof of mercurial action. In fact, the operation of mercury is that of producing a febrile action in some respects similar to hectic, that is, there is increased action of the heart and arteries, with an augmentation of the secretions; and we shall find, in a person who is the subject of mercurial action, that the pulse is quickened, that the secretions are increased, and the predominant increase may be in the saliva, in the urine, in the perspiration, or in the secretion from the bowels, that the muscular strength is diminished, and that the body wastes. We may be therefore satisfied if any of these effects are produced, and we must be careful not to push the operation too far."]

832. If the ulcer be obstinate, or the condition of the patient render the observation of the dietetic treatment already mentioned impossible, then sublimate must be used, beginning with the eighth of a grain daily and gradually ascending. In chancres which spread unusually quickly even during the internal and external use of the sublimate, in which the edges of the ulcer are extremely hard, and their surface has a carcinomatous appearance, the quieting and cleansing of the ulcer is effected merely by the external use of the red precipitate, and smart touching of the whole surface of the sore with lunar caustic. This local treatment is however, hurtful if there be general irritation present, under which circumstances only a soothing treatment to diminish the irritation should be employed.

The recommendation that in the treatment of primary syphilitic affections nothing should be applied locally, so that the changes of the sore may indicate more certainly the corresponding destruction of the disease by the mercury employed only internally, is objectionable, because by local treatment the sore is often easily brought to a simple state, and the longer the ulcer exists, the more is the general infection to be feared from absorption of the poison.

Delpech (*a*) considers that in primary syphilitic affections, mercury in the way of friction of *ung. hydr. cin.* may be most efficiently employed in the neighbourhood of the infected part for the prevention of general infection.

[When a chancre takes on a sloughing character, as described by **Lawrence**, it must not on any account be treated with mercury in any form, either internally or externally, for its employment will only aggravate the mischief, render the sore still more irritable and active, and hasten and extend the spread of the sloughing process. When, therefore, a chancre begins to slough under the use of mercury, that must be immediately suspended. The local treatment of brushing over the whole surface with strong nitric acid as recommended by **Welbank** (*b*), once or twice, is the best that can be adopted. In the course of a few hours, generally, the pain subsides, the sloughing process is arrested the angry red edges around the slough begin to grow pale, suppuration is set up, and the line of demarcation between the living and dead parts appears, and gradually deepening, the slough is completely defined, and slowly separates from the healthy parts beneath. After the application of the acid, a stimulating poultice of yeast, stale beer, or treacle, should be applied, either directly to the surface of the sloughing sore, or lint dipped in nitric acid wash, or in solution of chloride of soda, may be interposed. As in these cases there is always great restlessness as well as depression of the constitutional powers, opium, either as laudanum, or as the salts of morphia, must be given in sufficient quantity to produce quiet and sleep. The patient's strength must be supported by the most nourishing diet, and brandy, or gin, or porter, or both, in sufficient quantity, must be given; two, four, or six ounces of the former, with one or two pints of the latter daily, are almost always requisite, as these frightful cases usually occur in persons, especially women, who are accustomed to live almost entirely on spirits and can take little food. Some recommend the application of leeches upon the inflamed circumference of the sore, but they should never be used as they only assist in diminishing the patient's powers, already too much depressed.

The recovery from this complaint, after the separation of the slough, is very slow, and the discharge very profuse; good diet, with the spirits, or porter, in diminishing quantity, is, therefore, to be continued; and the wound may be treated, either simply with nitric acid wash and poultice, with the latter alone, or with some mild greasy application, to which the medical attendant will be guided, by observing what best agrees with the sore, and which will not be the same with all patients.

It is a very interesting fact, that secondary symptoms, after sloughing chancre, are extremely rare, the disease seeming to exhaust itself by the virulency with which it has seized on the part attached. Therefore, mercury ought not on any account to be exhibited as a preventive against symptoms which probably will never occur.—J. F. S.]

(*a*) Above cited.
(*b*) In Med.-Chir. Trans., vol. xiii.

833. If the ulcer heal with this local and general treatment, the internal use of the mercury must not at once be given up, but should be continued in smaller doses for some time.

834. The *treatment* of Buboes is to be guided according to the degree of their inflammation. If they be painful, the patient must be kept quiet, cold poultices of bread crumbs with lead wash, linen dipped in lead wash applied, and leeches, or even bleeding employed if the patient be strong and inflammatory affection of the whole body be present. In the more cold swellings gray mercurial ointment is to be rubbed in, and mercurial and hemlock plaster applied over it. In hard swellings softening poultices are especially serviceable.

Idiopathic buboes have a decided disposition to suppurate; when, therefore, the dispersion of a bubo does not easily and soon follow, it must not be urged by violent remedies, but suppuration must be promoted by softening poultices, by mercurial and hemlock plasters; and this treatment must be continued till the bubo have opened itself (1). These remedies serve also, after the opening of the bubo, to resolve the surrounding hardness. The still remaining ulcer must be treated as a venereal sore. To prevent burrowing of the pus, enlargement of the opening is frequently necessary. The violent dispersion of an idiopathic bubo may accelerate the outbreak of the general venereal disease. If the bubo run on to hardening, then besides the proper mercurial cure must be employed friction of gray mercurial ointment with camphor, hemlock and mercurial plaster, or friction of iodine ointment.

According to my experience, I assent to the opening of buboes in the same manner as abscesses, by a simple puncture, by a transverse cut, by the introduction of seton threads or by caustic, as advised by many persons (*a*).

The compression of buboes recommended by **Ferguson** is especially employed by **Fricke** in connexion with strict antiphlogistic treatment. Any hard properly-shaped body, for instance, according to **Fricke**, a piece of wood or a stone sown up in linen will answer the purpose (2). For the dispersion of buboes without distinction of their nature and duration, **Reynaud**, **Ricord**, and others have recommended the application of blisters of the size of a shilling or half-crown upon the middle of the swelling, and after the removal of the cuticle raised by the blister to touch the part with a feather moistened in a solution of sublimate, twenty grains to an ounce: if, after two hours, no slough has been produced, the touching is to be renewed and a bread poultice applied (3). The suppurating parts heal in a few days, and by continued use of the poultice, the bubo either entirely subsides, or it diminishes and disappears at the second or third application.

[(1) A bubo should always be punctured, as soon as fluctuation can be felt near the surface, with a moderately large opening; about half an inch in length is generally I think sufficient, but some Surgeons prefer slitting it up from end to end, and believe it heals more readily, I think, however, the less large aperture is sufficient. Occasionally it happens, whatever be the size of the opening, that the pus will burrow and sinuses will form. If not irritable these may often be cured by gentle and well-applied pressure from the extremities of the sinuses towards the wound, care being taken to leave the latter free for the discharge of the pus. This, however, will not always be effectual, and it then becomes necessary to lay the cavities freely open and keep them so by inserting lint between their edges; and this may be either dipped in black wash or nitric acid wash, or smeared with red precipitate ointment. Oftentimes the ulceration continues eating beneath the skin of the edges of an indolent open bubo; which thus undermined, has a bluish appearance, with a white irregular and insensible edge, and has not sufficient power to take on the adhesive action and unite with the parts beneath. It must then be removed, which is sometimes done by shaving off with the knife. I think, however, destroying it with strong nitric acid is best, as it produces a healthy excitement, and the skin usually soon shoots over the sore surface. The quantity of undermined skin will show the medical attendant how much should be

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(*a*) **Fricke**, chirurgische Annalen des Hamb. Krankenhauses, vol. i.

destroyed at a time; if there be little, one application of the acid is sufficient; but if much, it will be advisable to destroy portions successively till the whole is got rid of. If a bubo take to sloughing, as it will do occasionally, it must be soothed, or even treated with nitric acid as directed for sloughing chancre. I have known it destroy life by ulcerating the femoral artery and producing fatal bleeding. I doubt not much benefit would be derived by taking up the artery above the sore.

(2) I am not in the habit of using pressure for dispersing buboes, but I have seen it occasionally beneficial.

(3) Of the employment of sublimate after blistering to produce a slough I have no experience, but think it must be rather sharp practice. The application of blisters alone to indolent buboes is often very advantageous; sometimes they excite the absorbents, and the swelling is removed; at other times they excite increased vascular action, and the bubo suppurates, and after opening, or having been opened, gets well: so that in either case the blister does good service. I have occasionally removed the skin from the blistered surface and dressed it with iodide of potash ointment, or with mercurial ointment, and with beneficial result.—J. F. S.]

835. The treatment of the general venereal disease requires a more powerful use of mercury than in primary syphilitic affections. Mercury is employed *internally* or *externally*.

836. The external use of mercury is to be recommended only in those cases where the patient cannot bear it even in connexion with opium, mucilaginous remedies and so on, in consequence of habitual purging; in some persons also especially on account of pains in the bones. This mode of treatment, however, usually excites little salivation, and by many persons cannot be borne on account of the peculiar sensibility of the skin. From half a drachm to a drachm and still more of the gray mercurial ointment is to be rubbed on different parts of the body daily or at longer intervals. Sublimate baths have also been recommended, and the rubbing in of half a drachm of sublimate with as much muriate of ammonia every evening upon the soles of the feet, (after they have been softened by some days' previous warm foot-baths,) together with the simultaneous use of a lukewarm bath every other day, of decoction of sarsaparilla (*a*), as also the rubbing in of red precipitate, dry or mixed with spittle, and many other modes of treatment (*b*). The last two modes of treatment are, however, much less efficient than rubbing in gray ointment.

837. In the ordinary and not very old cases of venereal disease, the internal use of mercury is preferable to the external. The *mercurius solubilis* of HAHNEMANN, or calomel, are given; or because these preparations easily excite salivation, which prevents their continuance, sublimate is especially used. Under this treatment the patient must closely follow the dietetic rules already laid down, and according to the different degrees of irritation they must alternate with the preparations of mercury.

838. Besides this general treatment, certain appearances of *Lues* require especial attention.

In syphilitic ulceration of the throat and palate the pencilling recommended by RUST (*a*) is especially useful, and to be applied once or twice a day to the surface of the ulcer by means of a pencil of charpie (1).

In syphilitic eruptions washes of sublimate water, of *aqua phagadenica*,

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(*a*) CIRILLO, Praktische Bemerkungen über die venerischen Krankheiten, translated from the Italian by DÄHNE. Leipzig, 1790. There is also a French translation by AUBERT. Paris, 1803.

I am sorry I have not been able to see either the original or the translations of this work, for I cannot imagine the possibility of half a drachm of sublimate being recommended to be rubbed in nightly. —J. F. S.

HUFELAND, Journal der praktischen Heilkunst. 1819, March.

(*b*) ANSIAUX, Clinique chirurgicale.

(*c*) ℞ Merc. subl. corros. gr.vj.—xii.
Extract. cicutæ,
——— flor. chamom. āā ʒij.
Tinct. anodyn. simp. ʒj.
Mell. rosar. ℥j.

sublimate baths, various kinds of mercurial ointments, and drinks operating on the skin, are employed (2).

If the granulations do not diminish under the general mercurial treatment, they must be washed with a strong solution of sublimate, strewed with savine powder touched with caustics, especially with *liq. hydr. nitr.*, or removed with the knife or scissors, and the places where they were, touched with caustic. Even when the general *Lues* has been long cured they are often extremely obstinate.

Syphilitic diseases of the bones require a commensurate mercurial cure, according to some, especially *Mercurius nitrosus* and wood drinks. In nodes and gummatous swelling, hemlock poultices and rubbing in mercurial ointment with opium are used. In most cases, these swellings, which depend on exudation beneath the *periosteum*, become softer, less painful, and gradually diminish, and a slight depression and irregularity remains in their place. In *tophus*, irritating remedies, as mercurial and hemlock plasters with ammoniacum or blisters are to be used ; and the same applies to *exostosis*. But if these swellings be accompanied with inflammation, leeches are to be applied and mercurial ointment rubbed in. In pains in the bones the combination of mercury with opium internally and externally is fitting, and the use of wood drinks (3).

[(1) Mercurial fumigation of the throat in syphilitic ulceration of the tonsils and *pharynx* is a very efficient mode of treatment, as the mercurial fumes get at all those parts of the sores which cannot be reached by pencilling. Nitric acid, or chloride of soda gargle, are also very useful applications.

(2) When secondary syphilitic sores have formed, which, as LAWRENCE has observed, are sometimes the result of pustules, and which pustules, it might have been added, often commence in vesicles, the scabs generally assume a conical form, and sometimes attain great height by circular rings being continually produced at their base, corresponding with the enlargement of the sores, resulting from the confined matter producing ulceration by its pressure; and, as at this part the scab is softest, it bulges around the sore, and thus ring below ring of scab, each of greater circumference than the other, is produced, and thus a graduated or step-like conical scab is formed which has close resemblance to the scab of a rupial sore. If this scab be rubbed off the edges of the wound are very painful and irritable, and soon set about forming another, but imperfect scab, which worries the patient exceedingly. So long as such scabs reman on the sores, so long do they continue increasing and the sores spreading; and, as theiy are thick and hard, no application to them is of the least service. They should therefore always be removed by poulticing, after which, by the application of red precipitate ointment, together with constitutional treatment, they generally heal kindly. The same internal remedies for such eruption will not always be found suited to different cases. Sometimes the use of generous and strengthening diet, with porter or wine, is sufficient, as such patients are usually much out of health and worn down by the suppuration. It is, therefore, advisable always to commence with this mode of practice, with the risk of a reappearance of secondary symptoms, which is not unfrequent. But sometimes this treatment is utterly useless, and it is requisite to use mercury to affect the constitution: this must, however, be done with the greatest caution, and with constant watching. If the sores improve and the patient's appearance betters, and he begin to get flesh, it is a proof that this is the proper treatment; if, on the contrary, the sores become more irritable and spread, and there be increased general disturbance, the mercury must be left off, and the general irritation quieted if possible by merely soothing treatment with sarsaparilla or gentle tonics and sedatives—either opium or *hyoscyamus*. But it may be still necessary to resume the mercury, and sometimes, though the constitution will not bear it at its first or second use, it will at last seem to yield to the necessity of its employment, will first bear with it without seeming benefit, then gradually become accustomed to it, and at last improve under it, and be freed from the disease. I have seen this result again and again, and I am convinced of the occasional absolute necessity for the employment of mercury in this form of syphilitic eruption, although it may at first seem to be impossible to persist in its use. The other forms of syphilitic eruption are more quickly and effectually cured by the

use of mercury, but they may also be cured by iodide of potash, which is a most valuable remedy for persons, who, as occasionally happens, cannot bear the use of mercury; which, however, I believe much less frequent than supposed, and that rather the failure is in want of proper attention on the part of the medical attendant in the use of the medicine, than in the action of the medicine itself. In the employment of iodide of potash in these eruptions it must not be expected that the disease is at once cured; for such is not the case. The eruption not unfrequently recurs two or three times, as if a contest were going on between it and the medicine, but it is at last worn out and appears no more. I must confess, however, that if the patient's constitutional appearance do not oppose it, I prefer treating these eruptions with mercury, as the cure is more speedy and most certain.

(3) The best and most certain treatment for nodes is that by mercury which must be continued for six or seven weeks; and under its use these swellings, whether from fluid or from the actual diseased growth of the bones, slowly but steadily subsides, so soon as the constitution becomes affected. The same effect takes place even more rapidly by the use of iodide of potash, which may be taken internally in doses of from three to five grains, with a dram of syrup of poppies, and in either decoction of sarsaparilla, or compound infusion of gentian with some warm tincture. The quick absorption under this treatment is often very surprising, but the cure is not permanent, and the nodes reappearing again and again, call for the repetition of the medicine till the disposition to their production is overcome, just as in the eruptions already mentioned. It is rarely necessary in these cases to cut down through the skin and *periosteum*, as was formerly almost always practised when there was much fluctuation; and its absorption may be hastened by blistering, and either dressing the sore with simple ointment or with iodide of potash ointment. But when fluctuation is accompanied with much pain and tenderness, and with redness of the skin, and the swelling increases instead of diminishing, then it may be expected that suppuration has taken place, and it is best to make a free incision for the escape of the matter. If this be not done, the pus gradually separates the *periosteum* more extensively from the bone, and there is great danger of it being destroyed. This death of bone from syphilitic suppuration beneath the *periosteum*, is more common on the skull, than elsewhere and more serious, as not unfrequently both tables of the bone are destroyed. It rarely however happens except in persons of irritable habit and broken up constitution. Such fluctuating nodes should therefore be emptied by incision, if they do not early yield to the local and constitutional treatment.—J. F. S.]

839. I have endeavoured to point out the various preparations of mercury according to their special and ascertained operation on the several conditions of the disease; it must, however, be premised on this point, that there are indefinable peculiarities in certain constitutions. There must therefore be a variation of these preparations, when one preparation has at first produced improvement, but on long continuance and more powerful application no further benefit results; or if from one preparation even in an increased dose scarce any advantage is gained, in such cases the preparation selected is not suited to the constitution. In syphilitic ulcers with severe inflammatory symptoms, every employment of mercury is at the onset improper; baths, softening and purgative remedies are alone to be employed, and in strong persons blood-lettings.

Besides the mercurial preparations already mentioned, there have been of late brought into use *Hydrarg. phosphor.* to grain doses, (STARKE,) the iodide and bromide of mercury $\frac{1}{8}$th of a grain three times a day, (VON GRAËFE,) and the *Hydr. cyanic.* to $\frac{1}{3}$rd and $\frac{1}{16}$th of a grain dose (MENDAGA, PARENT.)

840. The *Flow of Spittle* (*Salivation*) is not necessary for the cure of the venereal disease, and is rather to be avoided, as thereby the further use of the mercury is interfered with, and often no trifling destruction of the mouth and teeth produced. When, therefore, the precursors of salivation, as swelling of the gums, metallic taste, and offensive breath have set in, the dose of mercury must be diminished, the preparation changed, or it must be entirely given up. The patient must be kept warm, and

when these symptoms have subsided, the mercury must be resumed. When salivation has commenced, many remedies are advised; as purgatives, sulphur, camphor, opium, blisters, and so on, but experience does not confirm their particular effect. The most suitable, however, are keeping warm, change of linen, warm bed, attention to keeping the bowels open, the use of astringent gargles for the mouth; internally, bark, acids, especially the phosphoric. It must not, however, be overlooked that in confirmed *Lues* it is necessary for its fundamental cure, that the mercury should be continued to incipient salivation, which should be kept up for several weeks, as frequently that alone proves the sufficient operation of the mercury upon the constitution.

841. In cases of very old venereal disease, in which often the modes of treatment prescribed are insufficient, several very active modes of cure have been proposed, among which may be especially reckoned, 1, the *Friction* and *Hunger Cure*; 2, the *Mercurial Cure*, after WEINHOLD'S plan; and, 3, ZITTMANN'S *Decoction.*

842. The *Friction-Cure*, long since (*a*) highly esteemed, has recently been brought into great repute by LOUVRIER (*b*) and RUST (*c*). The latter has also extended its employment to diseases not syphilitic, of which, however, a complete destruction is the foundation of the reproductive processes. The mercury does not, in this treatment, operate as a specific against scrofulous, gouty, syphilitic and other diseases, but simply as exciting the activity of the lymphatic system, by which the absorption may go on to completion, the previous degeneracy return to the natural condition, the entirely useless deposits be got rid of, and so a perfect consent of the organism produced.

843. This cure is indicated in syphilitic disease where disordered digestive organs forbid the internal use of mercury; when from the mercury a too little or too great affection of the bowels or of the whole system occurs; when the *syphilis*, having become a general affection, attacks the bones and tendons; when *caries*, exudation into the joints, hardening or disorganization of the different tissues are present; and when the *syphilis* will not yield to the internal use of mercury: in diseases not syphilitic, in which from mere gouty, scrofulous, or rickety causes, swellings in the skin, glands, and bones, growth or other diseased affections are produced as the result of an anomalous vegetation, and cannot be removed by other means, for instance, swellings of the joints, dropsy of the joints, *spina ventosa*, and wide-spreading ulcers: also in herpetic, leproid eruptions, hardening of the testicles, of the breasts, and so on. Even in those cases where diseases arise from simply local causes, hardening and degeneration of the cellular tissue, callous changes, carious destructions, fistulous ulcers and the like, which on account of their unnatural condition and situation often for years withstand every kind of treatment, even the repeated application of the knife, or even render the latter impossible.

844. The friction cure is always a very severe mode of treatment, and for the patient, accompanied with much trouble (1). It must therefore not be employed on those patients who are very weakly, who have very irritable nerves, in hysterical, hypochondriacal patients, in those who are much disposed to agitation or are affected with other diseases, as complaints of

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(*a*) FABER, above cited.

(*b*) Above cited.

(*c*) Ueber die Heilkraft der methodischen Quecksilbereinreibungen in syphilitischen und nicht syphilitischen Krankheiten; in his Magazin für die gesammte Heilkunde, vol. i. p. 354.

the chest, coughing up of blood, hectic fever, dropsy, scurvy, and the like. When, however, these diseases are the consequence of *syphilis*, the friction-cure is indicated. The skin of many persons has also a too great or too little receptivity for mercury, which at first cannot be determined. In the former case generally the cure is not completed ; in the second no cure ensues.

[(1) I cannot at all agree with CHELIUS's opinion on this point; for, beyond all doubt, the employment of mercury by friction is the mildest mode in which it can be used, and the only way in which it should be used, if imperatively called for, in the very cases where CHELIUS forbids it. One very important point must not, however, be lost sight of, to wit, the support of the constitution by generous diet, with porter or wine.—J. F. S.]

845. The cure itself primarily consists in the proper preparation of the patient by bathing, purging, and a strict diet, by which the susceptibility for the operation of the mercury is increased and the absorbing process promoted, so that even a smaller quantity of mercury may produce the alteration of the constitution. The patient should first take a purge, then every other day a bath not warmer than 29° R. [= about 97° FAHR.] Without any contrary indication twelve baths should be taken, but where the destruction of an important part is to be feared, then less may be used. In robust full-blooded persons the effect of the cure is always rendered more powerful by one or two blood-lettings. Phlegmatic puffy persons often derive no benefit from bathing, and therefore must not bathe beyond three days. During the use of the bath, and subsequently during the rubbing in, the patient should take thrice a day a lightly boiled porridge of a pint of meat broth with some grits, barley, rice; or instead of the porridge a cup of coffee on the first day, also some boiled ripe fruit or pears ; and for drink a decoction of *rad. bardanæ*, *liquiritiæ*, and *altheæ*, not exceeding three pints in the twenty-four hours. But frequently it is necessary with old weakly persons to give more strengthening diet, wine, meat broth, with eggs and the like. In women the preparatory treatment must be complete before the commencement of the menses ; and when they are over, then the rubbing in may be begun. If the menses recur at every fourteen days, the treatment must be so arranged, that they should have ceased before the critical days, and not interfere either with the medical treatment or with the evening frictions. If it should come on unexpectedly during the cure, the friction must be put aside. After the bathing is finished a second purge is to be ordered, and then the rubbing in proceeded with.

[Of all the preparations here recommended English Surgeons take no heed, excepting the clearance of the bowels at the onset, and a light unstimulating diet during the treatment. Nor is there any necessity to suspend the rubbing, in women during their monthly courses.—J. F. S.]

846. Twelve rubbings are nearly always sufficient to cure the inveterate venereal disease ; frequently from five to six, most commonly nine ; mostly no syphilitic disease requires more. Nothing definite can, however, here be fixed ; the number of rubbings must depend on circumstances. For rubbing in, at first one drachm, and afterwards one and a half or two drachms of well-prepared gray mercurial ointment is to be used. The hand with which the rubbing is to be done should be previously warmed before the fire, and the rubbing should be continued five minutes.

According to WEDEMEYER (*a*), in old and stubborn cases from eighteen to twenty

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(*a*) Bemerkungen über die Syphilis und ihre verschiedenen Formen und den Gebrauch des Quecksilbers in derselben ; in RUST's Magazin, vol. ix. pt. ii. p. 297.

rubbings of a drachm and a half each are necessary; in very old and very stubborn cases, especially if the salivation be backward and sparing, from twenty-four to thirty rubbings of a drachm and a half each, but seldom more are required. On the contrary, Rust (*a*) thinks he has never found this necessary; but when it was practicable, he increased the quantity of the ointment to be rubbed in commonly to two, two and a half, and even to three drachms, which agrees with my own experience.

[Our common hospital practice is to rub in a drachm of mercurial ointment every other night till the gums begin to swell, become spongy and sore, and the flow of spittle be increased; which effected, the rubbing is continued either as frequently or less frequently according as the soreness of the gums and the salivation continue the same or increase. The state of the gums and the flow of spittle are not, however, always indicative of the effect of the mercurial rubbing on the constitution; often is there neither soreness of gums nor salivation, but other excretions are increased, as the perspiration, or urine, or both, or there may be neither even of these, but the constitutional affection is shown by the wasting of the body and of the strength. The best guide, however, is the condition of the sore, which improves as the rubbing lays hold on the constitution. —J. F. S.]

847. The following is the order in which the rubbings-in are to be conducted:

On the first day, in the morning, the patient rubs in the prescribed quantity divided on the two legs, on the third day on the thighs, on the sixth day on the two arms, from the wrists to the shoulders, on the eighth or ninth day on the back, from the hips to the neck. From the seventh to the fifteenth day, according to circumstances, two, three, or four rubbings on these parts may be made in the way mentioned. Between the fourteenth and sixteenth day a more or less remarkable change occurs in the patient. He becomes restless, anxious, his breathing is oppressed, the pulse quickened, tongue loaded, and the belly puffed up. At the same time come on colicky pains, palpitation of the heart, crying out in his sleep, troublesome dreams, rumblings in the belly, and so on; from which discomforts the patient is relieved by a perspiration often continuing from twenty-four to forty-eight hours, and by increased secretion from the bowels and kidneys. On the sixteenth day another rubbing is to be made at evening, then on the next morning a purge, and so continuing to the twenty-fifth day, when, if there be not convulsions, severe oppression, great weakness, and so on, an early termination of the cure may be expected. On the twenty-sixth day the patient is to be put into a warm bath, and after half an hour washed quite clean with soap-spirit and a sponge, and dried. He is then to have fresh linen and to be carried into another room. The patient must during the whole cure be kept in a regularly warm room, and should neither get up, change his linen, nor cleanse the parts smeared with the ointment.

848. The following are the principal symptoms to be observed during this cure. The salivation usually appears between the fourth and fifth rubbing in, and is only to be checked when severe. The inconveniences attendant upon it may be best diminished by syringing the mouth with mild or slightly astringent decoctions. If the tongue swell so that it squeeze itself between the teeth, a piece of cork must be introduced between the grinding-teeth. But if from its swelling there be danger of stifling, the cure must be suspended and the tongue scarified. Ulcers on the tongue and gums are to be touched with a mixture of a drachm of camphor to an ounce of oil of almonds. The patient must frequently move his tongue to prevent its growing together.

If the salivation appear before the third rubbing-in, a smaller quantity

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(*a*) Above cited.

of the ointment must be used, and at more distant intervals. But the salivation frequently diminishes when the rubbing in is continued, and nearly always if it be restricted to the evening. The salivation oftentimes continues after the cure is completed and ceases of itself. If during the whole cure there be no effect upon the salivary glands, it must not be forced; the hope of a happy result is then, however, always slight. In this case there often occur frequent intestinal and urinary evacuations, increased perspiration, and critical symptoms. Spasms, faintings, high fever, weakening perspirations, if occurring previous to the third rubbing in, and cannot be removed by chamomile and peppermint tea, by old wine, coffee, HOFFMANN's spirit, and require the suspension of the cure.

From my own experience I cannot recommend the modification of the *friction-cure* adopted by some, and formerly known by the name of the MONTPELLIER treatment, or *steam-cure,* in which the diet is neither so strict, nor the rubbing-in made so regularly, or in such quantity as directed by LOUVRIER and RUST to produce salivation; but it is rather endeavoured to avoid it by suspending the rubbing-in, by purging, and so on; and then the friction is recommenced, and subsequently wood drinks are employed.

849. If the salivation or critical sweating be checked by cold and so on, in consequence of which severe spasmodic symptoms and even sudden death may ensue, the patient must be cleansed in a warm bath, put into a clean warm bed, the whole body rubbed with warm cloths, and with these also may be employed, mustard poultices, diaphoretics, and even emetics.

850. During the time of the evening frictions spasmodic symptoms, oppression, fainting, convulsions, nausea, and small contracted pulse, which often arise, are either forerunners of a second crisis, especially if the fifteenth day be not completed; or they are consequent on the use of purgatives. In the former case, stimulating remedies must be given; in the latter, the operation of the purgative must be stopped, and the next time a less powerful one given. But if under this treatment the symptoms do not subside, the treatment must be suspended.

851. When the cure is perfected, the patient, by the use of nourishing food, care being taken to avoid overloading the stomach, soon acquires a healthy blooming appearance: but if this do not follow, there is great probability of an imperfect cure. Should it be necessary still to repeat the cure once more, the patient must be first recovered from the previous treatment.

852. WEINHOLD (*a*) employs a *grand Mercurial Cure* with calomel, which, as well as the friction cure, may be of greater service, and not only in old syphilitic, but also in rheumatic, scrofulous, and gouty diseases, as well also as in those cases in which often we are unaware on what the diseased action depends. Its object is, that a sufficiently large quantity of calomel should, at long intervals, so operate on the organism, that no salivation should be produced, because it would prevent the continuance of the calomel, and suspend the operation of the mercury on the unnatural reproduction.

853. In this cure the patient takes every evening, two hours before bed-time, on an empty stomach, a powder of ten grains of calomel and fifteen of sugar, and drinks two cups of warm beef tea; half an hour after,

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(*a*) Von den Krankheiten der Gesichtsknochen und ihrer Schleimhaüte der Ausrottung eines grossen Polypen in der linken Oberkieferhöhle, dem Verhüten des Einsinkens der gichtischen und venerischen Nase und der Einsetzung künstlicher Choanen. Halle, 1818. 4to. p. 36.

he takes a second like dose, and if he be a strong person, at the third half-hour he takes half a dose, so that together twenty-five grains of calomel and six cups of beef tea are taken. He then goes to bed, and drinks in the morning a couple of cups of moderately strong coffee, which usually produces three or four thin motions. If this do not happen at the tenth or twelfth hour after having taken the medicine, a powder of fifteen or twenty grains of jalap, and as much tartrate of potash, must be given in order to produce at least *one* evacuation. After two days' rest, the patient must, according to circumstances, take the same dose of calomel in two or three portions; on the seventh day, the third; on the tenth, the fourth; on the thirteenth, the fifth; on the sixteenth, the sixth; and the conclusion is made on the nineteenth or twenty-first day, with the seventh or eighth dose. As at the third and fourth dose the stomach becomes accustomed to the irritation of the mercury, from five to six grains of jalap must he added to each dose. At the same time, a weak decoction of bark must be taken to support the reproductive powers, whilst the mercury destroys the dyscrasic. During this cure the patient must keep in-doors at least two or three hours in the forenoon, to promote perspiration; in not very bad weather he may, without harm, go about his business. The principal object of this treatment is, to produce stools, because they more certainly prevent salivation; but if that come on, which frequently happens in persons who have already used much mercury, the cure must be suspended.

854. Zittmann's decoction (*a*) is to be used in the following manner: on the first morning the patient takes sixteen portions of *pil. merc. laxant*; on the four following days he drinks in the morning a bottle of warm *strong*, and at noon a bottle of not warmed *weak* decoction; on the sixth day, again he takes the purging pills, as at first; and on the four following days, the decoction in like manner. Herewith the patient should eat only two ounces of roast meat, and as much white bread daily; and soup three times on those days when the purge is taken. The patient keeps in bed during the whole time, for the purpose of properly producing the perspiration. After the use of the decoction, he should keep his room for some time, drink infusion of *spec. lignorum*, or of sarsaparilla, and observe a weak diet. If the patient be not restored, the whole cure must be repeated a second time. In very robust persons, the purging pills must be once given on the eleventh day. The ulcers during the cure are merely to be cleansed with lukewarm water, and covered with charpie, either dry or spread with mild ointment. On an average, the use of the decoction is followed by five or six, and more, thin watery motions, and more or less, great perspiration. I have never noticed any accident which rendered breaking off this cure necessary. In largely spreading eruptions and very weak persons, it may be advantageous that only one bottle of the decoction should be drunk daily for the purpose of lengthening the

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(*a*) ℞ Rad. sarsæ ℥xij. et coque cum
Aq. font. ℔xxiv. pro 4 hor., et adde
Alum. sacchar. ℥jss.
Merc. dulc. ʒiv.
Cinnab. antim. ℥j. in nodul. ligat. sub fine coct. admisce
Fol. senn. ℥iij.
Rad. liquirit. ℥jss.
Sem. anis. vulg.
—— fœnicul. āā ʒiv.
Colat. lib. xvi. D. ad lagen. viii. S. *Decoct. forte.*

℞ Resid. decoct. fort.
Rad. sarsap. ℥vi. coq. cum
Aq. fontan. ℔xxiv. sub fine coct. adde
Pulv. cort. citr.
—— cinnamomi.
—— cardamom. āā ʒiii.
Rad. liquirit. ʒij.
Colat. lib. xvi. D. ad lag. vii. S. *Decoctum tenue.*

cure by the prescribed diet. Frequently the pills are thrown up and then they must be again taken in divided doses. Nausea, disposition to vomit, and even actual vomiting, during the use of the decoction subside, if a smaller quantity of the decoction be drunk at one time. I have observed, in one instance, severe pain in the belly every time after taking the weak decoction, and frequently a gentle, not very lengthened salivation, has been noticed (*a*).

The Arabian treatment and dry diet resembles that with Zittmann's decoction (*b*).

Here also must be mentioned the plan of treatment proposed by Dzondi (*c*), in which the patient commences with one-fifth of a grain of sublimate in four pills, taken immediately after dinner; from day to day the medicine is increased by two additional pills, so that on the last day of the cure, which occupies twenty-seven days, thirty pills, or 1½ grain of the sublimate, is taken at a dose. All this time the patient lives moderately, keeps himself warm, and drinks sarsaparilla tea. If the cure be disturbed by salivation, after that has been relieved, the number of pills still remaining must be continued. If mercury have been previously immoderately or irregularly used, sulphur should be first employed internally or in baths.

According to Kluge (*d*), Dzondi's treatment is not *to be depended on;* in certain cases, however, especially in ulcers of the bones and nose, it is very efficacious.

855. In reference to the efficacy of the friction-cure, of Zittmann's decoction and of Weinhold's treatment, I must undoubtedly give the preference to the former over the latter, which, according to my experience, more frequently checks than actually cure the disease; often indeed it cannot be borne, and may often continue injurious and scarcely to be gotten rid of disturbance in the functions of the alimentary canal, which depend on an usual and peculiar treatment. The friction cure and Zittmann's decoction, in general, act more surely; but the latter is connected with by far less inconvenience to the patient, on which account, according to my present experience, I prefer Zittmann's decoction to the friction cure, and only employ the latter when the former has been inefficient. The effect of this decoction I have proved, not merely in all forms of syphilis, but also in other inveterate disease.

Compare my above-mentioned statement, in which I have endeavoured to contradict the opinions put forward by Neumann (*e*) against the friction-cure, and in favour of Weinhold's mode of treatment.

What is the result of Weinhold's treatment, when, from the coming on of salivation, it be not determined to interrupt the cure, (which Weinhold and Neumann expressly enjoin,) I cannot from my own experience determine.

(*a*) Chelius, Ueber die Anwendung des *Decoct.* Zittm. im Vergleiche mit anderen gegen inveterirte Lustseuche und andere Krankheiten empfohlenen Behandlungsweisen; in Heidelb. klinisch. Annal. vol. i. pt. i. p. 116.

Hacker; in Heidelberger klinischen Annalen; in Rust's Magazin, vol. xxxix. pt. i. p. 1.—vol. lxvii. pt. ii. p. 203.

Habel, Ueber die Heilkraft des Zittmann Decoctes in secündarer Syphilis; in Med. Jahrbüchern des östen Staates. Neue Folge, vol. ix. 1835.

Martius, Einige Bemerkungen über das Decoctum Zittmanni; in Heidelberg med. Annalen, vol. ix. pt. iii. p. 418.

(*b*) S Gandy, Aperçu sur l'efficacité du Traitement dit arabique dans les Maladies Syphilitiques ou anciennes ou dégénérées. Montpellier, 1827.

Klaatsch; in Rust's Magazin, vol. xvii. p. 177.

Schæffer, Dissert. sur l'emploi du Mercure Sublimé et le Traitement arabique dans les Maladies Syphilitiques. Strasbourg, 1825.

(*c*) Dzondi, Neue zuverlässige Heilart der Lustseuche. Halle, 1832. Second Edit.—F. A. Simon, jun., Ueber den sublimat. und die Inunctionskur, mit besonderer Beziehung auf Dzondi's neue zuverlässige Heilart von Lustseuche, und die Louvrier-Rust'sche Inunctionskur. Hamburg, 1826.

Bartels einige Bemurkungen über Dzondi's neue Heilart der Lustseuche; in von Graëfe und von Walther's Journal, vol. ix. p. 513.

(*d*) Bericht über die, auf höheren Befehl mit der Dzondi'schen Heilmethod gegen die Lustseuche in dem Berl. Charité-Krankenhause angestellten Kurversuche und deren Resultate, nebst Gutachten über die Methode selbst; in Rust's Magazin, vol. xxvi. p. 211.

(*e*) Vergleichung der Louvrier'schen und Weinhold'schen Methode, das Quecksilber anzuwenden; in von Graëfe und von Walther's Journal, vol. ii. p. 405.

Wittcke, Dissert. de Weinholdii Hydrargyrum adhibendi methodo. Berol. 1821.

Neumann, über die Lustseuche; in von Graëfe und von Walther's Journal, vol. xvii. p. 1.

Heinze, Ueber die Bekämpfung der Lustseuche durch eine modificirte Inunctionskur, u. s. w. Wien, 1836.

2.—TREATMENT OF SYPHILIS WITHOUT MERCURY.

856. The various diseased conditions which have been considered incompatible with the use of mercury, as great debility, with a disposition of the juices to deficient mixture, suppuration of internal organs, aneurisms, scorbutic diathesis, have, on the one hand, as also the evils ascribed to the use of mercury, have on the other, led to the proposal of the various modes of treatment *without mercury*. To these belong, the sudorific decoctions of the *radix sarsæ*, *caricis arenariæ*, *chinæ*, *astragali ex scapi*, *and bardanæ*, of the *lignum guiaiaci*, *cortex mezerei*, *stipites dulcamaræ* and green walnut shells. Pollini's decoction, the *rob anti-syphilitique* of Laffecteur, the sarsaparilla cure of St. Marie, (drank like mineral water,) Vigoroux's drink, the hunger cure of Osborn and Struve, the volatile alkalies, (Bernard's *Tinctura anti-syphilitica*,) various antimonial preparations, the acids, especially muriatic acid, gold, especially its muriate (1) ; hydriodate of potash, and various other remedies. These modes of treatment were, for the most part, less destined for the primary, than for the secondary and older symptoms of the venereal disease, especially for those where much mercury had been already used without effect ; or where, on account of the state of the constitution, its use could not be borne. The greater number of these remedies had merely ephemeral reputation, and could not supplant mercury.

See my opinion already given upon Zittmann's decoction, in which the greater number of these modes of treatment have been more fully mentioned, and their effects compared.

Gold, first substituted for mercury by Pitcairn, but especially introduced by Chrestien, was as gold filings, gold powder, oxide of gold, and muriate of gold, (Chrestien's salt of gold,) recommended in primary and secondary syphilitic affections; it increased the appetite, raised the pulse and heat, produced thirst, burning of the gums, salivation, (of a milder character without smell, without ulcers, and not exhausting as when mercury is used,) febrile re-action, sweating, increased secretion of urine. It called forth the syphilitic symptoms previously suppressed, and the recovery when it took place was permanent. The effect is greater in using the salt, less in the use of the oxide, and weakest with the powder. In an irritable state it could not be employed. Of the gold powder, the first grain was divided into twelve, the second into eleven, the third into ten, and the fourth into nine parts; it was used so many days as there were parts into which the medicine had been divided, and it was rubbed into the tongue, the gums, or the sensible parts of the face. In buboes and very painful ulcers, rubbing in the powder or salts of gold was effected with cerate. Very numerous observations show that the effect of the gold against *syphilis* was much less and more uncertain than Chrestien and Niel had held: in our climate, large doses (according to my experience) are required to bring about the before-mentioned results. In irritable constitutions gold is a dangerous remedy (*a*).

Ricord (*b*) treated in 1824 of the use of iodine in gonorrhœa and bubo; Eusèbe de Salle is fond of it in hard swellings of the testicles, and also Lallemand, Biett, and Pailland; but especially Wallace (*c*), Robert Williams, M. D., Judd (*d*), Tyrrell (*e*), Ebers (*f*), Von Hasselberg and others (*g*) have used the hydriodide

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(*a*) Chrestien, Méthode iatraleptique Paris, 1814. Second Edit.

Gozzi, Sopra l' uso di alcuni remedii aurifici nelle Malattie Veneree annotationi teoretico-pratiche. Bologna, 1817.

Dictionnaire des Sciences Médicales,—Art., *Jatraleptique*.

Percy; in Journal Complémentaire du Dict. des Sciences Médicales. Oct., 1818.

Odhelius; in Hufeland's Journal, vol. xliv. p. 117

Delpech, above cited.

(*b*) Journal Complément., vol. xix.

(*c*) Wallace, above cited.

(*d*) Judd, A practical Treatise on Urethritis and Syphilis. London, 1836.

(*e*) Tyrrell, On the use of Iodine in Syphilis. ℞ Iodin. gr. [illegible]; potass. iod. gr. ¼; syr. papav. ʒiv. aq. destill. ℥viij. Ft. mist.; coch. duo ter die sumend.

(*f*) Ebers, Ueber Anwendung des Kali hydrojod. gegensecundäre Lustseuche; in med. Veriarzeitung in Preussen, 1836, 5 October.

(*g*) Staberoh; in Casper's Wochenschrift, 1838. No. 5.

of potash in the different forms of the general venereal disease, and in doubtful cases, with remarkable success. The iodine tincture, the hydriodic acid and iodine strong have been used; the hydriodide of potash, however, with especial success. According to **Wallace**, two, three, or four table-spoonfuls, and according to **Hacker** (*a*) eight or nine spoonfuls daily are given, of a mixture composed of hydriodide of potash two drams, and distilled water eight ounces. Its operations generally are increase of the vital activity, cheerfulness, increased appetite, increase of flesh, brighter colour of the skin, return of sleep, greater activity of the excreting organs; sometimes diarrhœa and colic; in one case salivation occurred (*b*). The hydriodide of potash is especially efficient in secondary syphilis, with increase of substance particularly in the bones and skin. **Hacker** observed in eleven cases that there was always remarkably quick improvement, but not proportionately quick cure. The treatment must often be continued for more than two months. According to **Evers**, the urine is to be tested during the cure with sulphuric acid, with solution of starch or of chlorate of lime.

[(1) **Forster** gives some cases (*c*) of syphilis cured by the conjoined use of chloride of gold and soda, and observes, " in all these cases and in some which have since occurred, the only *evident* effect of this remedy was, the perspiration, which gradually diminished in quantity as the system became accustomed to the stimulus. In only one case was any dressing but dry lint applied, and this difference did not seem to be influential." The form of preparation of this remedy was the following:—" Dissolve ninety-six grains of pure gold in nitro-muriatic acid; evaporate and crystallize; dissolve the crystals of the chloride of gold obtained, in pure water; add thirty grains of *decrepitated* chloride of soda. Evaporate the solution and crystallize. The salt is slightly deliquescent, and must therefore be kept in a stopped phial."

857. In England, however, the treatment without mercury, formerly restricted to the so-called pseudo-syphilitic diseases, has been extended to all syphilitic affections, and this has been continued and mercury discarded for more than eighteen years in the greater number of the military hospitals, and by many of the most distinguished civil practitioners (1). The mode of treatment is the following:

In primary syphilitic sores, as long as their inflammatory character continues local, and in severe inflammation general blood-letting must be employed, especially in phimosis and paraphimosis; the patient must preserve the strictest quiet, and be continually in the horizontal posture; he must use purging neutral salts and strict antiphlogistic diet. The local treatment of the ulcer is to be guided only according to its special condition and not with reference to a specific contagion. In painful sores with everted, hard, irregular edges, and scabs, softening anodyne fomentations and applications must be used two or three times a day; and after these symptoms have subsided, solutions of lead, of sulphate of zinc and copper, lime water, and so on. In phagedenic and gangrenous sores, whilst inflammation exists, bleeding must be employed with strict antiphlogistic diet, softening anodyne applications, afterwards solutions of lunar caustic, diluted sulphuric acid, tincture of myrrh, turpentine and similar remedies, in which the frequent change of the remedies specially promotes the healing, and very much seems to depend on keeping the dressings moist. In indolent ulcers more stimulating remedies must be employed. By this treatment all ulcers of the generative parts may, without exception, be healed in a short time. The dispersion of buboes is to be promoted by a compressing bandage, and in their painful state they must be treated by the frequent application of leeches. If suppuration occur, the abscess must be opened with caustic, and the wound afterwards treated as a primary sore. Secondary symptoms, when occurring after the just-mentioned treatment,

(*a*) **Hacker**; in Summarium, u. s. w., vol. viii. part vii. 1836.

(*b*) **Bultock**; in Edinb. Med. and Surg. Journ., 1837.

(*c*) Lancet, 1829-30. vol. ii. p. 590.

appear as inflammation and ulcers of the throat, eruptions of various kind, inflammation of the eyes, periostitis, and swellings of the bones. If these symptoms be very mild they may be cured by sudorific woody drinks, antimonials, strict diet, and antiphlogistic treatment, agreeable to circumstances. Severe and dangerous symptoms, as great and continued pain in the bones, *caries*, destructive ulcers of the throat and other parts, will never be seen after this treatment.

[As regards the continuance of this treatment, the frequency of buboes following upon primary ulcers, and subsequently the occurrence of secondary symptoms, the opinions of English practitioners differ from each other. According to HILL, ulcers with the proper syphilitic character heal in from eight to twenty-five days; according to HENNEN, the primary in fifty-five and the secondary in from fifty-five to eighty-five days. Previous mercurial treatment and scrofulous constitution have special influence on the difficulty of the cure. The proportion of the secondary to the primary symptoms is, according to ROSE, 1 : 3; to GUTHRIE, 1 : 10; to THOMSON, 1 : 12; to HENNEN, 1 : 5; and to HILL, 1 : 10.

(1) It must not be supposed that the practice of treating syphilis without mercury is at all the general practice throughout England; for beyond all doubt it is decidedly the reverse, as the treatment of these cases in almost all, if not all, the civil hospitals, and by the greater number of Surgeons proves. It is not to be supposed, however, that mercury is used in the profuse and improper manner in which in former times, and even within my own recollection, it was employed for true syphilitic symptoms, either primary or secondary. Nor indeed is it used for all or for a large proportion of sores on the genitals, in which heretofore it was indiscriminately prescribed. The Surgeon now first takes care to discriminate between the syphilitic and non-syphilitic sore, and adapts his treatment accordingly, with mercury, under careful regulations, for the former as a specific, but for the latter, as either an alterative, or simply as an occasional purge, taking care at the same time to improve the general health by diet, medicine, and good air.

Far from employing mercury too frequently or too freely, the fault is now rather in the contrary direction, and an imperfect cure is the result of leaving off that medicine too quickly, and not continuing it a week or ten days or more after the symptoms have apparently subsided, whilst in reality the syphilitic poison has not been entirely cast out. The consequence of this is, that secondary symptoms, especially eruptions, are, so far as I have had opportunity of observing, much more frequent than formerly. The Surgeon therefore should be especially cautious, that whilst he avoids overdosing with mercury, in whatever form it be used, that a sufficient quantity should be administered to affect the constitution fully, and this should be steadily, though moderately, kept up till some days after all symptoms have disappeared. CHELIUS's own observations in the following paragraph fully bear out all here mentioned.—J. F. S.]

858. Many of the objections formerly made against this plan of treatment when the here mentioned observations had *not* been sufficiently numerous nor sufficiently long continued, though the pseudo-syphilitic affections were cured by it, but not the true syphilis, have on the contrary lost all weight, if it be remembered how long this treatment has been employed, and by some of the most experienced and best instructed English practitioners. The frequency of the secondary symptoms always remains as the most important objection; but seeing that we are still in want of careful and sufficiently numerous statements in reference to the employment of mercury, so must, after the impressive testimony of the English practitioners, the mild and by far less destructive character of the secondary symptoms outweigh this objection. Certain as it may be on the other hand, that by the *immoderate* use of mercury, syphilis assumes a peculiar destructive character, so little can I, however, agree with the banishment of mercury in the treatment of syphilitic diseases, that I am convinced by experience, that a moderate use of mercury, with a strict and corresponding dietetic treatment, effects more quickly and constantly the cure of syphilis,

The reproach, that the mercurial treatment of syphilis first imparts to it a direct destructive character, applies only to the negligent, common use of this remedy without reference to the constitution, and without correspondent mode of living. It is satisfactory in other respects to know, that in those conditions which especially contraindicate the use of mercury, this treatment may be employed with confidence.

For the literature of this subject, see—

Fergusson, Observations on the Venereal Disease in Portugal, as affecting the Constitutions of the British Soldiers and Natives; in Med.-Chir. Trans., vol. iv.

Rose, Observations on the Treatment of Syphilis, with an account of several cases of that disease in which a cure was effected without the use of Mercury; in Med.-Chir. Trans., vol. viii. p. 349.

Guthrie, On the Treatment of the Venereal Disease without Mercury.

Hennen John, Observations on the cure of Syphilis without Mercury, &c.; in Edinburgh Med. and Surg. Journal, vol. xiv. p. 201, 1818.

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SYPHILIS IN INFANTS.

[Infant children are occasionally affected with *syphilis*, either whilst still in the womb, during birth, or from sucking a diseased nurse. The latter two modes of infection are those generally admitted, but EVANSON and MAUNSELL state that "the first mentioned has been in their experience by far the most usual, and that they have not in their own recollection any cases decidedly proving the occurrence of the third." I do not, however, see any sufficient reason why infection during delivery should be infrequent, as it is far from uncommon that the medical attendant of a woman with primary sores, and whose hands are not long in contact with the sores, becomes subject of chancre. EVANSON and MAUNSELL state that the communication of *syphilis* to the *fœtus* in the womb "happpens commonly in one of the following ways: one or both parents may have the disease at the time of the conception of the child, or they may have had it previously, and perhaps, at the period in question, present no sign of ill health whatsoever. Under either of these circumstances a child may be born apparently healthy, and continue so for an uncertain period, (varying from a fortnight to five or six months,) when marks of *syphilis* may show themselves; the most usual period for the disease to appear, is, according to our experience, from the third to the fifth week." (HUGUIER (*a*) says that *syphilis* shows itself in an infant in from three to thirty days after birth.) "In this way the symptoms may be developed in several successive children of the same parents, but usually such cases are alternated with miscarriages or premature births of children, dead and covered with syphilitic eruption; or all these occurrences may take place in the same family: for example, a woman may miscarry once or twice; may then produce a dead syphilitic child, and subsequently give birth to one apparently healthy, but showing disease when it has attained the age of four or five weeks. There is no regular succession in the occurrence of these different events, as they indifferently precede or follow each other. During the whole period of the production of these diseased children, both parents may appear perfectly healthy, and one of them may never have had any sign of the disease." The child may also be infected from a syphilitic nurse, but whether simply from the infected milk, or whether only from sore nipples, I am not prepared to state; for though DYCKMAN (*b*) maintains that a child may become diseased simply by the milk of an infected nurse, LAWRENCE's case presently mentioned, however, seems to disprove this statement. But, on the other hand, the child can infect the nurse, of which the case related by JOHN HUNTER (p. 413) as one instance of disease resembling *syphilis*, is a most excellent example, for the history of the case proves beyond all doubt that the disease was genuine *syphilis*, and the child successively infected three wet-nurses, by the first two of whom their own children were consequently infected. LAWRENCE also mentions a case in which a syphilitic child gave the disease to a healthy woman who nursed it, but at the same time, her own child having been kept at the other breast, did not receive it. "The woman that so nursed this child had a primary sore on the breast, an affection of the absorbent glands, and an eruption over certain parts of the body similar to what we would regard in other cases as secondary symptoms of the venereal disease. The child then appearing to be well, was put to a second nurse, who had also a primary sore on the breast, and eruptions on the body; she became pregnant, and five weeks after delivery her infant was covered over from top to toe with syphilitic eruptions." (p. 783.) Whether in these cases the nurse be infected through a sore on her nipple, or merely by the application of the poison to the skin, is disputed. COLLES doubts whether the child can infect the nurse unless she have ulceration of the nipple. TODD mentions (*c*) a very remarkable case of an old woman of seventy years of age who spoon-fed her grandchild, which was infected with *syphilis*, and died a fortnight after birth. Three days after the woman had a rash on the arms like itch, and in three or four days more she had excrescences on the *labia*, a few elevated blotches on her breast and back, and a deep ulcer in each tonsil. This woman was speedily cured by the mercurial treatment.

When a child is born dead, and has been so for some time previous, its putridity prevents determination from its appearance of the existence of the disease; but when born alive, "the child appears healthy for an uncertain period (from a fortnight to five or six months) after birth. The first distinct symptom usually is the occurrence of a peculiar mode of breathing through the nose, known by nurses as the *snuffles*, (and depending on the nostrils being inflamed and stuffed with a thick viscid yellow secre-

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(*a*) Archives Générales de Médecine. Aug., 1840.

(*b*) On the Pathology of the Human Fluids.

(*c*) Surgical Report, containing an account of those Affections of the Penis which are generally considered as primary symptoms of Syphilis, &c.; in Dublin Hospital Reports, vol. ii. p. 182.

tion); at the commencement this is attributed to cold, and seldom attended to until the eruption appears. In the interim, however, the child's health is much affected, and without any obvious reason. It has no bowel complaint, and is not undergoing dentition, but yet wastes away, and is feverish, fretful, and pallid. In about a fortnight an eruption comes out rather suddenly, at first upon the lower extremities and buttocks, and subsequently upon the face and body; * * * first in the form of copper-coloured blotches, about the size of a split pea, and slightly raised above the level of the skin. These are, in a slight degree, moist upon the surface, and in situations exposed to the air they soon become scaly, and subsequently are converted into dark-yellowish scabs. Where portions of skin are naturally in contact, as between the buttocks, in the wrinkles of the neck, &c., scales are not formed, but raised condylomatous sores. As the disease advances, the skin in the intervals of the scabs becomes throughout of a copper colour, and perpendicular fissures are formed in the lips, giving the mouth a very peculiar and characteristic appearance, which cannot be verbally described, but to those familiar with the disease, is in itself diagnostic of its real nature. The voice at this period becomes feeble and stridulous; the inside of the mouth often covered with *aphthæ;* extreme emaciation attends, and, if medical aid be not afforded, the child is reduced to a state of excessive debility, and lies covered with disgusting scabs and ulcerations." (EVANSON and MAUNSELL.) In addition to these, LAWRENCE mentions that he has seen two cases of *iritis* as symptoms of *syphilis* in infants; and that sometimes there are ulcers pretty much indurated, that is, with a superficial edge, and rather indurated base, about the *anus*. "The *diagnosis* is to be derived partly from its history, but in investigating this the greatest caution is required, as a hint of any suspicion upon the subject might, in many instances, be productive of the most unhappy domestic results.* * * The snuffles of *syphilis* having nothing at first to distinguish them from those of common catarrh, the disease with which the eruption is most likely to be confounded is common itch, which in the delicate skin of the child may assume a frightfully severe form. It is to be known from *syphilis* by its pustular character, by the itchiness which it occasions, and by the absence of the copper colour of the skin, and the peculiar fissured appearance of the mouth. Itch is also commonly communicated to the attendants. * * * The *prognosis* is always favourable when the case is seen early and properly treated, few diseases being more under the influence of medicine. If left to itself, however, *Syphilis infantum* is certainly fatal.

"The *treatment* is exceedingly simple—mercury being always required, and, when judiciously exhibited, seldom failing to produce a beneficial effect. * * * Administer from one to two grains of *hydragyrum cum cretâ* two or three times a day (according to the age) until the eruption and snuffles disappear. The child usually fattens under this treatment; and salivation is never produced, at least we have never seen it, in a child under three years of age. Should the mercury affect the bowels, which sometimes happens, we must combine with each dose from half a grain to a grain of DOVER's powder, or of the powder of chalk and opium. The time required for treatment is from six weeks to two or three months, and the medicine should always be continued for two or three weeks after every symptom has disappeared; even when this precaution has been observed, the disease may return and the mercurial treatment must be again and again resumed." Black wash or dilute citrine ointment may be applied to the sores, and when they become indolent they may be stimulated with nitrate of silver or sulphate of copper. Giving mercury to the nurse so as indirectly to affect the child is insufficient for the cure of the disease in the latter. "When the mother is suckling her own child it will be well to treat her with alteratives, as for example, sarsaparilla; but unless she labours under actual syphilitic symptoms the giving of mercury to her should not be thought of until the child is weaned, as by affecting her general health it would be likely to deteriorate her qualities as a nurse." (EVANSON and MAUNSELL.) Some practitioners make use of corrosive sublimate in treating syphilitic infants; but it is objected to both by SWEDIAUR and BACOT as likely to disagree and produce violent griping.

In connexion with this subject one very important question may be here adverted to, namely, whether *syphilis* can be communicated by co-habitation, if the husband labour only under secondary symptoms. HEY is of opinion that the wife may be so infected, although he is not able to state any positive facts supporting it. LAWRENCE also says that the same is the impression on his mind from circumstances that have come under his own observation; and TODD's case of the grandmother already mentioned might be brought in support of these views, as in her case as well as in those of married people, the only conceivable way of the infection being communicated is, the application of the secretion of the secondary sores to the surface of the healthy party. It must not, however, be forgotten that **Hunter**, from experiment, asserted that the secretion of secondary sores is not infectious, and **Ricord** says that his own experiments on the same point have confirmed **Hunter's** statement. The possibility of infection from secondary *syphilis* would therefore seem more than doubtful; and I am rather disposed to believe, that in cases where it is said to take place, that the male patient purposely deceives his medical attendant with a false history of his ailment or of the correctness of his moral conduct after marriage, than that two so able and attentive observers as **John Hunter** and **Ricord** should be in error. Be this however as it may, the consequences to the female and her children are so distressing and so serious, that in my opinion an infected person ought not to be allowed intercourse with his wife; or should at least be warned of the results which, according to the opinions of some able and experienced Surgeons, might by possibility accrue from such intercourse.—J. F. S.]

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859. The immoderate and too long continued use of mercury, especially with improper dietetic treatment, and catching cold, produces a peculiar cachexy, which has been first well described within the last thirty years, as the *Morbus Mercurialis* (1), *Erethismus Mercurialis* (2), *Erythema*, and *Exanthema Mercuriale*, &c.

This disease has various stages, and appears,

1. As an *eruption* which generally occurs on suddenly catching cold, during the use of mercury; it is preceded by a feeling of great debility, oppressive sensation at the pit of the stomach, and frequent horripilations, followed by increased heat, quick pulse, head-ache, *nausea*, and thirst; then pale, or dusky-red vesicles, rarely a purple-red eruption without vesicles, or similar to nettle-rash, appear most commonly first on the

purse, on the insides of the thighs or fore-arms, and gradually spread over the whole body. After a shorter or longer time, the cuticle is shed in thin whitish scales; but if the ailment be left to itself, a large quantity of vesicles or pustules arise which contain an acrid, stinking, very irritating fluid, and on their bursting more or less thick crusts are formed by the drying of the fluid (3).

2. As *ulcers* in the throat and mouth which are characterized, not merely by their grayish-white and flabby appearance, but also by their whole external form, which is more easily distinguishable by the eye than to be described by words. Pain and tension arise in the soft palate, and in the tonsils, with heat and a peculiar sensation of dragging of the palate towards the hinder part of the nostrils; much excoriation on the soft palate, the *uvula*, and tonsils, and actual ulcers, having the appearance of whitish discoloured spots, especially on the hinder wall of the *pharynx* (4). A peculiar characteristic is the disposition the ulcer shows to change its place. Even true syphilitic sores may, by the too long continued use of mercury, degenerate into mercurial sores. As the disease proceeds the pendulous palate is destroyed, and *ozæna*, *caries* of the nose-bones, pains in the bones, (wanting, however, the nightly exacerbation,) enlargement of the bones, and *caries* occur.

Upon the varied appearances and degrees of the mercurial cachexy, see the before-mentioned excellent Paper of DIETRICH.

[(1) CARMICHAEL does not hold with the notion of a mercurial disease. He says:—"In ascribing those symptoms (mercurial chancres, ulcers, pains, &c.) to mercury, we have entirely overlooked this obvious circumstance, that *that* medicine, when exhibited even to profusion for liver, or any disease which is not venereal, has never in any one instance produced those results. With respect to the deteriorating influence of mercury, I am perfectly willing to allow, that when it does not altogether supersede the actions of a morbid poison, it may so far alter or modify its symptoms, as to change, in a great measure the appearance and natural progress of the disease; but this is essentially different from an admission, that the remedy will produce symptoms which can scarcely be distinguished from those of the poison itself." (p. 46.)

LAWRENCE observes:—"Among the prejudicial effects of mercury, are enumerated, by those who are unfavourable to its use, eruptions, *iritis*, affections of the nose, affections of the bones, and affections of the joints, that is, a considerable portion of those symptoms which we know are secondary symptoms of *syphilis*. It has been contended by those who in modern times have been the great advocates for the treatment of *syphilis* without mercury, that a great portion of those symptoms ordinarily described as secondary, are really owing to the action of the remedies employed to counteract the *syphilis*. Now, in the first place, we may observe that all these symptoms may be produced without the employment of mercury; we know perfectly well that each of them is seen in individuals who have taken no mercury at all. We have, therefore, clear evidence that all these effects may be produced by the disease. We have not the same evidence that they may be produced on the contrary, by the employment of mercury. Mercury is given in many cases besides those of *syphilis*; it is given to a very considerable extent in other cases, but in no instance where it is given in other diseases do we find it produce eruptions like syphilitic eruptions; in no such instance, do we find it produce *iritis*, swelling of the nose, or of the bones, or of the *periosteum*. The effects then, in question can be produced by pox without mercury, but we have not the same evidence that they can be produced by mercury without pox; now, it is true, that mercury and pox acting together may produce a something that neither would produce singly. I can readily admit that the injudicious use of mercury; that the employment of it in cases in which it ought not to be used; that persevering in the employment of it in cases where it exerts one or other of its noxious effects, may aggravate the symptoms, may tend to produce their return more, readily make them more difficult of cure; and thus, I think, we can have no difficulty in admitting that the employment of mercury, under such circumstances, may add to the difficulties which may attach to the disease itself. I cannot, however, for my own part, see any evidence that mercury is capable of producing those effects which we are in the habit of observing from syphilitic poisons in cases where no mercury has been used." (pp. 731, 732.)

To the same effect, also, **TRAVERS** (*a*) observes, in speaking of syphilitic cachexia:—"Mercury, it may be said, has much to do with the production of this cachexia; as an aggravant, I do not deny this to be frequently the case, but not as an element." (p. 87.)

(2) The *Erethismus mercurialis*, as it was named by **JOHN PEARSON**, differs from either of the two forms of mercurial affections mentioned by **CHELIUS**, as from it results no local manifestations, but merely disturbance, severe enough indeed, of the constitutional powers. **PEARSON**'s attention appears to have been directed to this formidable complaint, by having "observed that in almost every year one, and sometimes two instances of sudden death occurred among the patients admitted into the Lock Hospital; that these accidents could not be traced to any evident cause, and that the subjects were commonly men who had nearly, and sometimes entirely, completed their mercurial course." (p. 154.) He obtained no satisfactory information by inquiring of his colleagues as to the cause of these fatal cases; but after having given "a constant and minute attention to the operation of mercury on the constitution in general, as well as to its effects on the disease for which it was administered, and after some time had elapsed, I ascertained," says he, "that these sinister events were to be ascribed to mercury acting as a poison on the system, quite unconnected with its agency as a remedy, and that its deleterious qualities were neither in proportion to the inflammation of the mouth, nor to the actual quantity of the mineral absorbed into the body. The morbid condition of the system which supervenes on these occasions during a mercurial course, and which tends to a fatal issue, is a state which I have denominated *Erethismus* (*b*); and is characterized by great depression of strength, a sense of anxiety about the *præcordia*, irregular action of the heart, frequent sighing, trembling partial or universal, a small, quick, and sometimes an intermitting pulse, occasional vomiting, a pale contracted countenance, a sense of coldness, but the tongue is seldom furred, nor are the vital or natural functions much disordered. [What then are to be considered the symptoms just mentioned.—J. F. S.] When these, or the greater part of these symptoms are present, a sudden and violent exertion of the animal power will sometimes prove fatal; for instance, walking hastily across the ward; rising up suddenly in the bed to take food or drink; or slightly struggling with some of their fellow patients, are among the circumstances which have commonly preceded the sudden death of those afflicted with the mercurial *erethismus*." (p. 155-57.) **BURDER** says (*c*):—"This peculiar irritation may arise from the administration of mercury in any form, and may occur during any period of a mercurial course, though most commonly at its commencement. The exact circumstances which favour its occurrence in the particular individuals attacked have not hitherto been ascertained. While resident medical officer of the Lock Hospital he has seen it produced by the inunction of a single drachm of mercurial ointment, and reproduced in the same individual after the discontinuance of the medicine for a whole month, by three frictions, each consisting of only one drachm of the ointment. It is remarkable, however, that in the greater number of instances, a full and adequate course of mercury has been afterwards borne without any recurrence of *erethismus*, by the very persons who had suffered from it during the commencement of the course." (p. 105.)

The seeming rarity of this disease, even "in public institutions where the atmosphere of the wards was actually loaded with the remedy," (mercury,) "would," as **BACOT** has very justly observed, "be a very imperfect mode of estimating the frequency of the occurrence of *erethismus*; because although few die, very many persons have been affected by it in an inferior degree, without, in fact, being at all aware of the cause of their sufferings." (p. 272.) To this I would, however, add, that this violent degree of constitutional disturbance is now rarely if ever seen even in hospitals, not only because their syphilitic wards are no longer polluted by a mercurial atmosphere, but because Surgeons, using mercury in the treatment of *syphilis*, take especial care to suspend or give up its use, when the constitutional symptoms show that the mercury is beginning to do mischief, and if persisted in would excite the irritable condition above described.

The relation of Dr. **BATEMAN**'s own case by himself (*d*) is probably the best account of this disease. Being the subject of *amaurosis*, he rubbed in a drachm of strong mercurial ointment nightly; on the seventh day his gums were a little tender, and he had slight fever at night; on the eighth he was languid and feverish, and the gums reddish

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(*a*) A further Inquiry concerning Constitutional Irritation, &c. London, 1835. 8vo.

(*b*) Principles of Surgery. London, 1788. 8vo.

(*c*) **FORBES, TWEEDIE**, and **CONOLLY**'s Cyclopædia of Practical Medicine, vol. ii.—article, *Erethismus Mercurialis*.

(*d*) Notes of a Case of Mercurial Erethism; in Med.-Chir. Trans. vol. ix. p. 220.

and spongy; on the following day he had violent and irregular action of the heart, which did not yield to laudanum or stimulants, but went off suddenly in the afternoon; on the next two days he was severely griped and purged; on the tenth day, the mouth being sore, and the irregularity of the circulation continuing, the mercury was omitted, but as he was more comfortable on the following day, it was resumed, but the palpitation returned, and continuing on the twelfth day, the mercury was abandoned. During the whole of the following month the symptoms of irregular action of the heart, of extreme debility, and a strong tendency to *syncope*, accompanied with cough, evidently proceeding from a deranged stomach, and attended with violent retchings, continued to increase in severity, and his condition became very precarious. No solid food could be taken without an alarming increase of the feelings of oppression and faintness; and stimulants, as brandy in small quantities, *ammonia*, and *æther*, were principally beneficial. Among the most curious circumstances of this case, was the impossibility of attaining sleep even for a very short period, without bringing on the most painful sense of suffocation and distress, so that he was obliged to be removed immediately into a current of fresh air. These attacks were so violent, and recurred so frequently, as to entirely banish sleep. He recovered, but for more than a twelvemonth after, complained of a hurried circulation, want of strength, and lassitude."

Pearson speaks of a *Cachexia syphiloidea*, of which he says, he has "not yet attained to that complete and satisfactory knowledge which would authorize him to obtrude a publication on the subject; but," observes, "the experience I have already had in the treatment of that multiform disease, has taught me that it may appear under the following different circumstances:—1. Where the syphilitic virus has lately existed in the constitution, and the patient has employed the accustomed course of mercury; 2. Where the patient has been repeatedly diseased with *syphilis*, and has used several courses of mercury; 3. Where a great length of time, from three to twelve, and sometimes twenty years, has elapsed since the patient has been exposed to the agency of the disease and its remedy ! ! 4. After the *gonorrhœa*, where small quantities of mercury have been used; 5. Where no venereal complaints, general nor local, have preceded the appearance of the *Cachexia syphiloidea*, and where the patient has never been exposed to the hazard of contracting that disease, nor has laboured under complaints requiring the aid of mercury." (pp. liv., v.) This is all he says upon the subject, and why he should prefer applying the term *Cachexia syphiloidea* to *Cachexia mercurialis*, which the disorder undoubtedly is, does not appear very satisfactory. No more reasonable is **Bacot**'s persistance in using the same title, under which he well enumerates the symptoms which occur in this affection, to wit, "emaciation, long-continued, and severe nocturnal pains and enlargement of the bones; severe and extensive ulcerations, fever, profuse perspiration, followed not unfrequently by hectic fever and death. The most usual history which a case of this kind affords, is that of a patient, who, perhaps for some common sore of no great extent or severity, has employed mercury until his health has given way, and until symptoms have arisen of so equivocal a nature as to lead to the belief that the original disease is making inroads into the constitution; it is under this conviction that the patient either devotes himself to a fresh course of mercury, or his Surgeon, if a decided mercurialist, advocates the same plan; from that moment the disease becomes complicated; bone generally becomes affected, fresh attacks of nocturnal pains, new and unobserved forms of eruption make their appearance, and are all referred to the original poison, until perhaps a severe form of fever is excited, or some local mischief obliges a discontinuance of the treatment. Then it is that the patient rallies, the constitution appears daily to acquire strength; but, as in this condition it is not unusual for the osteopic pains to be renewed, and partial relapses to take place, the fatal misapprehension is again renewed, until another exhibition of mercury effectually overpowers the efforts of nature, and the patient sinks under the exhausting influence of the remedy." (pp. 276, 77.)

"The mercurial cachexia," says **Travers**, "is characterized by irritable circulation, extreme pallor and emaciation, an acute and rapid hectic, and an almost invariable termination in *phthisis*, the utter destruction of the palate, extensive cicatrices, eruptions, or ulcers of an anomalous character in various parts of the body, and large cranial exfoliations are seen in combination with it." (p. 87.)

(3) This disease is called *Eczema rubrum* by **Willan** and **Bateman**, who state that it "is not exclusively occasioned by mercury, either in its general or more partial attacks; it has been observed to follow exposure to cold, and to recur in the same individual at irregular intervals, sometimes without any obvious or adequate cause." (p. 254.) "The quantity of this ichorous discharge," say these distinguished writers, "is very considerable, and it gradually becomes thicker and more adhesive, stiffening the linen

which absorbs it, and which thus becomes a new source of irritation; it emits also a very fetid odour. This process takes place in the successive patches of the eruption, until the whole surface of the body, from head to foot, is sometimes in a state of painful excoriation, with deep fissures in the bends of the joints, and in the folds of the skin of the trunk; and with partial scaly incrustations of a yellowish hue, produced by the drying of the humour, by which also the irritation is augmented. The extreme pain arising from the pressure of the weight of the body upon an extensive portion of such a raw surface, is sufficient to give rise to an acceleration of the pulse and white tongue, but the functions of the stomach and of the *sensorium commune* are not evidently disturbed by this disease. The duration of this excoriation and discharge is uncertain and irregular; when only a small part of the body is affected it may terminate in ten days, but when the disorder has been universal, the patient seldom completely recovers in less than six weeks, and is often afflicted to the end of eight or ten weeks. By so severe an inflammation the whole *epidermis* is destroyed in its organization; and when the discharge ceases it lies loose, assuming a pale brown colour, which changes almost to black before it falls off in large flakes. As in other superficial inflammations, however, the new red cuticle that is left is liable to desquamate again, even to the third or fourth time, but in smaller branny scales of a white colour, and a roughness sometimes remains for a considerable period, like a slight degree of *psoriasis*. In some instances, not only the cuticle but the hair and nails are also observed to fall off; and the latter, when renewed, are incurvated, thickened, and furrowed, as in *lepra*." (pp. 255, 56.)

Carmichael mentions that he "knew a gentleman who was always attacked by this eruption when he took but a single grain of calomel, and also an instance of the disease being produced by the application of the black mercurial wash to a venereal ulcer." (p. 326.)

"Although the *Eczema mercuriale* is produced by the action of mercury, yet the disease is not always exasperated by persisting in the use of it; for in some particular cases, 'where,' says Pearson, 'I judged it to be of great moment to continue the mercurial frictions, the eruption neither spread universally, nor was it materially increased, although the patients were not relieved from it till mercury was discontinued.'" (p. 173)

(4) Bacot says:—"The character of the mercurial ulceration of the throat is that of an aphthous superficial sore, surrounded with a general blush of inflammation. The tonsils are the usual seats of the ulceration, and they are sometimes also met with on the *velum pendulum palati*. Occasionally there is much stiffness and difficulty of swallowing, without the appearance of any breach of surface at all. Now, independently of the mere appearance of the sore, these symptoms will always be found in connexion with, or almost immediately following the use of the remedy—that is to say, that when towards the termination of a mercurial course, whether the effects of the mineral have been such as might have been wished for and expected or not, if the patient begins to complain of pain or difficulty in swallowing, and upon examination the tonsils are found either studded with small ulcers or affected with only one larger superficial sore, the patient being himself not quite free from fever, with disturbed rest and feelings of general discomfort, there can be no hesitation in believing that this disease is the result of mercurial action. The same symptoms making their approach within two or three weeks after the mercury has been discontinued, will also admit of the same explanation, and more especially if our patient, after having been confined to the house, or nearly so, during his cure, has been exposed to sudden or severe transitions of temperature." (pp. 265, 66.)]

860. The character of the mercurial disease is diminished cohesion and atony; it is a cachexy similar to the scorbutic. The means recommended for it are, leaving off the mercury, the employment of warm and strengthening dietetic treatment, *sarsaparilla*, *saponaria*, *smilax chinæ*, *dulcamara*, *bardana*, *guiaiacum*, mineral acids in connexion with wood-drinks, the *tinct. arom. acida,—sulphurico-acida* in decoction of fine buds or malt; mild, strengthening, and astringent remedies, bark, cascarilla, *folia aurantiorum* and *fol. ilicis aquifolii* in decoction or infusion; subsequently, steel. In the mercurial disease, disturbance of the functions of the liver usually occurs, against which the laxative extracts, and especially the *extract. chelid. maj.*, recommended by the English practitioners, in connexion with soda and the like, are of considerable service (1).

For the local treatment, penciling the ulcers with muriatic acid, and gargles of hemlock and honey; in the eruptions on the skin, sometimes antimonial, sometimes *guiaicum* preparations, *liq. sapon. stibiati, tinct. guiaic. ammon.*; in pains of the bones, bark, opium, and aromatic baths. STRUVE'S hunger-cure has been recommended as a most important remedy, as also the use of sulphur and ferruginous baths. If after the removal of this cachexy *syphilis* still exist, the red precipitate of mercury, with wood-drinks, is very efficient. Although it is characteristic of the mercurial disease, that it becomes worse under the use of mercury, and although this disease arises by the immoderate use of mercury, without *syphilis* being present, for instance, from the operation of mercurial vapour, and so on; yet, however, on the other hand, it is certain, that it frequently is only the consequence of immoderate and improper mercurial treatment, of a repeated suppression of the syphilitic disease, which however continues only under an altered form; a methodical suitable mercurial treatment is therefore capable of curing both the mercurial disease and the *syphilis*. From my own experience, I must give the preference to ZITTMANN'S decoction before all other treatment (*a*).

SCHMALZ has, in electrifying patients, in whom it could not be made out, which was to be considered the consequence of *syphilis*, or which of the immoderate and improper use of mercury, observed salivation occur without further employment of mercury, and to such an extent, that severe mercurial fever and profuse sweating came on at the fifteenth day. He administered the electric *aura* to the patient either by a dome placed on his head, or put the chain into his hand, and continued the electric stream at first only for a quarter of an hour. Therewith also he gave water-gruel, with medicine twice a day; took care to keep the bowels open, and to preserve the warm temperature of the chamber, which the patient was not allowed to leave (*b*).

[(1) "To prevent the dangerous consequences of this diseased state (*Erethismus mercurialis*) the patient ought to discontinue the use of the mercury," says JOHN PEARSON; "nor is this rule to be deviated from, whatever may be the stage, or extent, or violence of the venereal symptoms; the impending destruction of the patient forms an argument paramount to all others. * * * The patient must be expressly directed to expose himself freely to a dry and cool air, in such a manner as shall be attended with the least fatigue. It will not be sufficient to sit in a room with the windows open; he must be taken into a garden or a field, and live as much as possible in the open air until the beforementioned symptoms be considerably abated. The good effect of this mode of treatment, conjoined with a generous course of diet, will be soon manifested; and I have frequently seen patients so far recovered in the space of from ten to fourteen days, that they could safely resume the use of mercury, and, what may appear remarkable, they can very often employ that specific efficiently afterwards without suffering any inconvenience. * * * In the early stage the farther progress of mercurial *erethismus* may be frequently prevented by giving the camphor mixture, with large doses of volatile alkali, at the same time suspending the use of mercury." (p. 157–159.)

"As a general rule," in *Eczema mercuriale*, says PEARSON, "I would premise that the administration of mercury must be discontinued on the first appearance of the eruption. The *Eczema mercuriale* certainly admits of a natural cure, not only when it affects the body partially, but when it is universal; yet, although the troublesome symptoms which arise may be relieved by their proper remedies, I am doubtful whether any plan of treatment has the power of interrupting its regular course, or abridging its duration. I have been confirmed in this opinion of the inefficiency of any medical aid in curing the disease, in the proper sense of the term, by observing that under all the various modes of treatment which I employed, this disease, like some of the *exanthemata*, pursued its usual mode of progress, without undergoing any apparent change, either in the number of its essential symptoms, or in the comparative mildness and continuance of them." (pp. 176, 177.) PEARSON, however, thinks the patient may derive advantage from medical treatment, so that his general health should not suffer material or permanent injury; and recommends antimonial powder and saline draughts, or liquor of

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(*a*) WEDEMEIER, above cited.

(*b*) FRORIEP'S Notizen, 1826, Oct., p. 207.—HECKER'S lit. Annalen, Mai, 1827, p. 107.

acetated ammonia at the onset, with gentle purging, and opium to allay irritation either with camphor or **Hoffman**'s anodyne (*spir. æth. sulph. comp.*); and "when the discharge is no longer ichorous, and the tumefaction is subsiding, sarsaparilla with bark may be given liberally."

"The cure of the sore throat proceeding from constitutional irritation or cold taken upon mercury must," says **Bacot**, "be effected by purging, by antimonials, by an abstinent diet, as far as animal food and fermented liquors are concerned. * * * When all febrile heat is removed, the bark or sarsaparilla will be found of great efficacy in restoring the vigour of the constitution and expediting the healing of the sore." (p. 266.)]

The subjects *gummata* and nodes are considered under **Exostoses**.

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A.—OF CARIES.

(*Caries*, Lat.; *Knochenfrass*, *Beinfaule*, Germ.; *Carie*, Fr.)

861. *Caries* consist in a diseased change of the substance of bone, analagous to ulcers in soft parts (1). If the diseased bone be bared of the soft parts covering it, it is found to be brownish, often blackish, its surface rough and uneven, yielding, worm-eaten and destroyed to a considerable extent; the bony layers are fragile, may be easily penetrated with a silver probe, and a grayish brownish or blackish *ichor* escapes, which gives out a filthy and peculiar smell; the bony layers are frequently loosened, and spongy or fleshy growths (*Caries fungosa*) spring up from the surface of the ulcer (2).

[(1) " The term *caries*," says **Lawrence**, " does not apply to all the circumstances under which ulceration of a bone takes place. When a portion of a bone dies, that part is separated from the sound portion by a process of ulceration; but that ulceration does not come under the denomination of *caries*. Ulceration of bone, in fact, like that of the soft parts, is various in its nature. There is a healthy ulceration in soft parts, enabling them to repair injuries; and there is a similar ulceration in bone. Now to that healing kind of ulceration we do not give the term *caries;* but we apply the term *caries* of the bone to an unhealthy species of ulceration, an ulceration which is not of a salutary but of a destructive nature. This kind of ulceration, like the morbid ulceration of soft parts, is preceded by inflammation; the bone first inflames and then ulcerates, just as you observe in the case of a sore leg, where the skin inflames first and then proceeds into a state of ulceration. This state, too, is accompanied by the formation of matter, in which respect *caries*, or the ulceration of a bone, is analogous to the same process in the soft structures of the body. Such, then, is the sense in which we employ the term *caries;* it is a morbid ulceration of the bone, preceded by inflammation, and attended with some kind of suppuration or formation of matter." (p. 356.)

(2) As **Miescher** states, " Granulations are not entirely deficient, inasmuch as every bony surface, affected with *caries*, is covered with a certain soft substance, corresponding to the growing granulations in healthy suppuration; but they are of a bad kind, of livid colour, and when touched bleed easily; mostly they are scanty, but sometimes so luxuriate in a kind of fungus, that the roughness of the bone itself can be scarcely, or not at all, examined. Of whatever kind they be, they *never go on to scar*, but having been produced by humours, the commixture of which has been corrupted by general disease, and acquiring their life from that part of the body of which its own life has been altered by disease, they have an organic structure but little perfect, and only enjoy a short existence, in consequence of which they soon die, and together with them also larger or smaller particles of the bone itself. Under them new granulations sprout up, but unless the existing disease be got rid of, are not better than the former, and die also in a short time; and thus, with the *caries* always creeping further, the suppurative inflammation elsewhere of its own nature producing new substance, here seems to run on to nothing but a sort of destructive process. But nevertheless even in *caries* it appears nature provides, that new organic substance should be produced from the growing granulations, which although of scanty and of bad character, are never entirely deficient. Indeed this is often proved even by the formation of new bony substance; for dyscrasic inflammations as they are called, and especially the syphilitic, not unfrequently, from the very first, produce new formations, from which we know that *exostoses* are mostly first produced; but the very carious surface is sometimes studded with new bony, spiny, spongy formations, which as **Clocquet** observes, 'are analagous to the fungous flesh springing up in soft parts.' The surrounding *periosteum* is swollen, and between it and the bone itself new bony matter is poured out, and often forms large *exostoses*." (p. 209-10.)

" The distinguishing character of *caries*," observes **Syme**, " is the same as that of cancerous ulcers in the soft parts, viz., obstinacy of action. * * * The disease has, for the most part, remissions more or less complete, and of considerable duration, in which the pain and discharge nearly or altogether cease and the ulcer seems to be on the point of healing, or actually becomes covered with a thin soft *cicatrix*. But these amendments are only partially and temporary, being always followed by relapse, and there is no natural limit to the duration of the disease, except the life of the patient, who, after months, or even many years of suffering, becomes finally exhausted, either by the *caries* itself or some other disorder which the irritation produced by the *caries* has excited." (p. 170.)

" The diseased part," observes **Mayo**, " often neither can recover itself, nor be absorbed; neither does it become necrosed. Left to itself, the *caries* would continue year after year, undermining the constitution of the patient, gradually invading the adjacent sound bone and finally threatening with destruction the neighbouring joint. It is often extremely difficult to tell whether an inflammatory enlargement of bone is abscess, or *caries*, or *necrosis*." (p. 38.)]

862. These changes of the bone are always dependent on previous inflammation, which has its seat either in the *periosteum* and outer layers of the bone, or in the medullary membrane, in the *parenchyma* of the bone. The formation of a bony ulcer is therefore always preceded by dull,

deep-seated, frequently very severe, wide-spreading pain, with swelling, not very great but slow, over which the colour of the skin is not changed. After a shorter or longer time a swelling dependent on the collection of puriform fluid takes place, sometimes on the very seat of the diseased bone, sometimes at a distance from it, which, if the bone be covered with few soft parts, seems connected with it, and is surrounded at its base with a hard edge. If this swelling be opened, an ill-conditioned variously-coloured *ichor* is discharged, which sometimes has a very bad smell. If the destruction be great, hectic fever sometimes occurs. If the inflammation have begun in the interior of the bone, it is often thereby changed partially, or throughout its whole extent, into a spongy, wide-spreading mass accompanied with severe pains which increase especially as the patient warms in bed; the neighbouring soft parts are also much expanded, and finally fistulous sores arise (*Spina ventosa*, *Caries centralis*, *Pædarthroce*, Lat.; *Winddorn*, Germ.).

Besides these appearances the *diagnosis* is specially determined by examination with the probe, in which the bone is found rough and variously changed; further, by the peculiar form of the ulcerated openings in the soft parts, which have a shrivelled appearance, are contracted, and callous, or have their circumference surrounded with fungous excrescences. The silver probes employed in examining carious ulcers are frequently blackened; this, however, is no very definite sign, as it may be produced by any impure and ill-conditioned pus. The patient usually feels deep-seated pain.

[" In considering the primary attack of bone by *caries*, the question," says Miescher, " arises, in what way is the bony substance in this disease destroyed? how is it that suppuration, naturally producing a new substance, should in this case deviate into a destructive process? Comparison of *caries* with ulcers in soft parts throws no light on the subject, nor is it more set forth in them, how organic subtance is destroyed by ulceration. * * * Doubtless ulceration of bones or *caries*, is most suitable for clearing up this ambiguous question, because this tissue, abounding in earthy parts, even when deprived of life, for a long while resists chemical decomposition, and then may be distinguished in the pus or adhering to the very surface of the ulcer. We see it asserted in the works of not few writers, that in a carious ulcer the pus may be perceived to be as it were sandy to the touch, and containing bony particles oftentimes pretty apparent, and that if a probe cannot be used to the affected bone, that this alone certainly indicates *caries*. But nothing final can be obtained on this very point, as no one speaks distinctly upon the question. For what Himly (*a*) contends for, that the surface of the bone always dies, is not sufficiently confirmed by argument. And the same may be observed as to Bell's statement, that in *caries* there is often no exfoliation; and who has even described that peculiar form of it which he calls phagedenic, which spreads most rapidly on every side, without any exfoliation, and merely by the violently excited action of the absorbent vessels." (p. 210-12.) In the instances of *caries* in different bones examined by Miescher, he says:—" In all these, minute bony plates were discovered dead, and more or less separated; some entirely separated lay on the surface of the ulcer, and beneath them was a soft substance, consisting of numerous vessels, overspread with bone, as is constantly observed in a separated necrotic bone; some still adhered to this soft substance by some tougher filaments; in others the separation had proceeded less far, so that more or less still adhered to the bone itself. These dead plates were not only found on the external surface of the bone, but more frequently at that part where the ulcer penetrated more deeply, and their irregular surface appeared here and there covered with mucous dirty matter, which probably was produced by the decomposed soft substance. Elsewhere, this soft substance only was observed; in which places the dead parts seem to have flowed off with the *pus*. The whole surface therefore attacked with *caries* presented various stages of separation of the dead plates, by which the roughness felt with a probe, was easily explained as well as the corroded appearance of the softened bone, which although less conspicuous, is discovered after the separation of *large* pieces of bone." From the review of these circumstances and of those connected

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(*a*) Uber den Brand der harten und weichen Theile. Goett., 1800, p. 96.

with simple suppuration of bone, **Miescher** concludes, that "the organic matter in *caries* is destroyed by *necrosis*, and that *caries* might very properly be named '*necrosis* in particles,' as the very able and experienced **Rust** had called it in his Lectures. It appears that dead and separated bony particles are not to be found in every carious ulcer; for when that destructive process exists, ulceration proceeds no further, but it is only occupied in secreting sanious pus and producing granulations of a bad character, the previously dead particles having separated, and been thrown out with the *pus*, and no more make their appearance. It is further to be observed, that it is of no consequence what dead parts are separated and what destroyed by *caries*, but that in the destruction of the organic tissue much is to be attributed to the more active absorption as fitted for separating the dead parts." (212–13.)

"When a carious bone has been macerated, the diseased part," remarks **Syme**, "is found excavated and rough, the cancellated structure being remarkably spicular, white and brittle, so as to resemble a spongy bone which has been exposed to the action of fire. The surface thus affected, is often of considerable extent, though frequently very small, even in cases of old standing; but the disease seldom reaches to a considerable depth. The field of the disease seems to be determined by the primary inflammation, and after being thus established, has little or no tendency to become larger. Around the carious part there is always an effusion of new osseous matter, in the form of warts or tubercles, extending to a considerable distance, and greatly increasing the thickness of the bone. This new mass, which is no doubt produced in consequence of the irritation of the disease, like that formed to re-unite fractures, and supply the place of exfoliations, is characterized by compactness and smoothness when minutely examined, though on superficial inspection it appears rough and porous. The pores are apertures for the transmission of blood vessels, but their form is circular, and their edges rounded off, so that sharp edges cannot anywhere be perceived. The newly effused bone may thus be readily distinguished from the diseased part, to the irritation of which it owes its origin." (p. 170–71.)]

863. All injuries, producing inflammation of bone which ends in ulceration may be considered as causes of *caries* (1). They are either *external* or *internal*; to the former belong external hurts, kicks, blows, wounds, tearing of the *periosteum*, fractured bones, continued pressure, suppuration in the neighbourhood of the bone; exposure of the latter, especially if the air be freely admitted or the treatment have been improper. The internal causes are especially, *scrofula*, *syphilis*, scurvy, rickets, gout, rheumatism, suppression of customary discharges, *metastasis* after previous active or chronic eruptions of the skin (2). Ordinarily from the external causes rather the superficial, and from the internal rather the *parenchyma* or internal substance of the bone is affected. *Caries* most commonly occurs in the soft spongy bones.

As regards the distinction of bony ulcers from suppurating wounds of bone, and the exposure of the bone, what has been already said (*par.* 746) of the distinction of ulcers, especially from abscesses, here applies.

Delpech (*a*) believes that the diseased changes which *syphilis* produces in bones does not deserve the name of *caries*, as therein the bones suffer little from change in their structure, but rather become necrotic. Although this is commonly the case, as already mentioned, (*par.* 823,) yet is it, however an opinion, which cannot in general be assented to.

[(1) "In *caries*," says **Mayo**, "absorption is preceded by a change in the bone, which (with very few and doubtful exceptions) has a well-marked inflammatory character. The same condition exists during the progress of the absorption. There is further present an imperfect restorative action, which is shown in the more or less partial growth of unwholesome granulations from the ulcerated surface. Of these changes, the inflamed condition of the bone is the primary and most important; the absorption is secondary and accidental." (p. 36.)

(2) **Miescher** points out the seat of the various kinds of *caries* from internal causes as follows:—"*Scrofulous caries*, for the most part, attacks the spongy texture, as the bodies of the *vertebræ*, the carpal and tarsal bones, and the joint-ends of the long bones; beginning in the previously formed internal tubercles of which, it excites in them in-

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(*a*) Chirurgie Clinique de Montpellier. Paris et Montpellier, 1823, p. 454.

flammation and swelling, and afterwards attacks the soft parts, which at the commencement of the disease, were almost, or entirely free from it. The scrofulous differs especially from *rheumatic caries*, which is also situated in the joint ends, but arises from inflammation of the soft parts, the ligaments and synovial membrane, and thence sometimes seizes on the articular surface itself. The *arthritic* no less prefers the region of the joints, but attacks the external surface of the bone, having been mostly preceded by the formation of *exostoses*. In general, arthritic concretions are observed in its immediate neighbourhood. The *syphilitic caries* seems to be, next to the scrofulous, most frequent, but contrariwise, almost only resides in the compact substance of the bone; and then the *scorbutic*. These are especially distinguished, in that for the most part, the former is accompanied with the formation of *exostoses*, and that these *exostoses* are the seat of ulceration; whilst in the latter, but very rarely do *exostoses* appear." (p. 216.)]

864. The *prognosis* depends on the constitution, age, and circumstances of the patient, on the causes which have produced the *caries*, and on its seat. The prognosis is most unsatisfactory in very great general and especially in scrofulous ailment, and if the *caries* exist in the neighbourhood of a joint. If the hectic fever have exhausted the powers of the patient, the removal of the limb is often the only remedy. But in many cases, especially in young persons who have reached the age of puberty, nature effects the cure by her own powers, and in the following manner:—the air being kept from the diseased bone by the contraction of the fungous edges of the aperture of the ulcer, it either dies completely and is thrown off with suppuration as a granular powder, or in flakes, or in its whole thickness (*Exfoliatio sensibilis*); or it is removed by absorption, (*Exfoliatio insensibilis*,) whilst at the same time granulations arise from the bone, the suppuration improves and diminishes, and the external ulcer gradually closes.

865. As regards the *treatment* of *caries*, its causes must be first counteracted; the suitable mode of cure must be directed against *scrofula*, *syphilis*, rickets, gout, and so on, and close attention must be paid to the state of the patient's powers, which are to be supported by proper remedies, and especially by good nourishing diet, and by the enjoyment of good air.

866. The *local treatment* of the ulcers requires great cleanliness in dressing; the carious part must be defended from the approach of the air, and the free escape of the *ichor* must be provided for. To this end, if the situation of the ulcer in the soft parts do not permit the ready escape of the *ichor*, enlargement of the ulcerated opening is frequently needed. In other respects the local treatment agrees entirely with that generally applied to ulcers. The openings of the sores are to be covered superficially with lint, all stuffing and introduction of tents are to be avoided, moist warm applications of chamomile or other aromatic vegetables are to be used, rubbing in of volatile salves or spirituous fluids on the neighqouring parts, and the use of general or local aromatic baths. In inflammatory affections, leeches should be applied around; gray mercurial ointment rubbed in, and softening applications made. By this treatment it is expected that the vitality of the diseased bone may be changed, and that it should exfoliate imperceptibly or perceptibly; and in the latter case, provision must be made for the removal of the separated portion of bone. This mode of treatment is preferable to the use of injections of warm water, of slightly astringent decoctions, or aromatic vegetables, as chamomiles, oak, chestnut, or Peruvian bark, or green walnut shells; of dilute phosphoric acid, of a weak solution of sublimate, of lime water, kreosote, and so on; or if the secretion of the *ichor* be copious and stinking, some

slight aromatic remedy must be strewed in powder on the ulcers. But if the treatment mentioned be inefficient, the ulcers not being kept up by a general diseased cause, and the position of the carious bone permitting, the cure may be attempted by the removal of the carious part and the simple treatment of an exposed sound bone, by cutting into the *caries* of a rib, of the breast and collar bones, the skull and face bones, the bones of the *meta-carpus* and *-tarsus*, of the articular surfaces, if the *caries* be not very extensive. If the latter be the case with the bones of the limbs, and especially in the joints, and destruction is to be feared from hectic fever, amputation or exarticulation of the limb is the only remedy.

The numerous remedies proposed for *caries*, as *assafœtida*, phosphoric acid, *rubia tinctorum*, *semina phellandrii aquatici*, muriate of barytes and so on, are not sustained by experience. Rust (*a*) recommends pills of equal parts of *assafœtida*, phosphoric acid, and *rad. calam. arom.*, from six to ten portions, three times a day, as especially effective, particularly if *scrofula* be the cause of the disease. The use of acrid remedies, as *tinct. euphorbii*, *aloes*, *myrrhæ*, the acrid ætherial oils, and the like for the purpose of bringing about a more complete death of the diseased bone, for which purpose also the actual cautery has been employed, are to be entirely discarded, as their effect is not restricted merely to the diseased bone, but may also extend to the underlying healthy bone: only in *caries fungosa*, has the actual cautery often appeared to me advantageous. Fricke (*b*) considers the complete exposure of the diseased bone as the best mode of producing its quick exfoliation.

["The absorption may be prevented," says Mayo, "by subduing the inflammation; or may, having begun, be arrested, and the crop of unwholesome granulations converted into a healthy restorative growth, if the case is of such a nature as to allow of the suppression of the inflammatory or specific action." (p. 36.)

"The treatment must, in the inflammatory stage of *caries*, be antiphlogistic," says Lawrence; "take blood from the part locally, and adopt other antiphlogistic measures, and after this, counter-irritation, by the application of tartar emetic ointment, moxa, and so on, in the neighbourhood of the diseased bone. When we come to the ulcerative stage of the affection, we must employ the counter-irritant plan. So far as local means go, perhaps, we have no more effective methods of producing it, than by counter-irritation, issues, and moxæ. Further, as a local means of treatment, we are recommended, when the carious affection occupies a small portion of bone within our reach, to denude the bone, and remove the diseased part by means of Hey's saw, or a stout pair of scissors, or pliers, or by any other mechanical means, to cut away that which is the seat of disease." (p. 359.)

"The treatment of *caries*," says Syme, "is to be conducted on the same principle as that of cancer, and consists in the use of means which have the effect either of destroying the life of the morbid part, or of removing it at once from the system. There is this difference, however, that there being no malignant tendency to take on the same diseased action in the neighbouring parts, it is not necessary to remove any of them, except in order to gain access to the seat of the evil. Notwithstanding this favourable circumstance, it is found extremely difficult to eradicate the disease by depriving the part affected of its vitality. * * * The effect of all these applications, to wit, the concentrated mineral acids, nitrates of silver and mercury, red oxide of mercury, and the actual cautery, (with the view of killing the morbid part,) however carefully employed, is very superficial, and it is extremely difficult, if not impossible, to ensure their operation on the whole surface of the diseased part. They therefore always require to be frequently repeated, and generally prove quite inadequate to destroy the disease, unless it is very limited and accessible; and it is even not improbable that some of them, as the actual cautery, may occasionally make the matter worse, and extend the disease to the neighbouring bone, by exciting inflammation in it. For these reasons, excision ought to be preferred to caustics for removing the carious bone; and if the part affected be within reach, which can always be ascertained previous to commencing the operation, it may, by this method, be surely and thoroughly eradicated at once. If the disease is superficial, and of small extent, it is easily scooped out with a gouge, the toughness and compactness of the sound bone distinguishing it from the morbid portion.

(*a*) Handbuch der Chirurgie, vol. ii. p. 398.

(*b*) Fünfter Bericht über die Verwaltung des allgemeinen Krankenhauses zu Hamburg, 1832, p. 237.

If extensive and deep-seated, it is best removed by taking away the whole of the articulating extremities. When the situation of the *caries* prevents it from being cut out, amputation ought, if possible, to be performed; if this be impracticable, the disease will, sooner or later, prove inevitably fatal." (p. 172.)]

867. If from examination with the probe it appear, that the diseased bone is partially or completely loose, it must be seized with the forceps, and drawn out, for which purpose the ulcer in the soft parts oftentimes must be enlarged. Commonly after the removal of the bone, the part upon which it was situated is covered with granulations, which must be very carefully destroyed with stimulating remedies. In cases where a large piece of bone has been completely destroyed, but will not separate, its removal must be effected by taking hold with the forceps, and moving it backwards and forwards; or if this be insufficient, it must be assisted even with the trepan, or with the scraper, if the position of the diseased part permit.

B.—OF NECROSIS.

868. Its low degree of vitality, is the cause of bone easily dying, and *necrosis*, which is analogous to the gangrene of soft parts, occurs as a consequence of inflammation, suppuration, or of a considerable tearing of the *periosteum*. According as the *necrosis* occurs from inflammation and suppuration, or from destruction of the connexion of the nourishing vessels of the bone, it may be distinguished into *consecutive* and *primary*.

869. *Necrosis* takes place at every age, in every condition of life and in both sexes, although usually in childhood and at the period of manhood; it is most frequent in the compact part of tubular bones, in the shin-bone, thigh, lower jaw, collar-bone, upper-arm-bone, splint-bone, spoke-bone, and cubit; rarely in their spongy extremities. It also frequently attacks the flat bones. *Necrosis* is situated sometimes in the external, sometimes in the internal layer of the bone, or attacks it throughout its whole bulk.

All ailments which destroy the nourishment of the bone by the *periosteum*, or by the medullary membrane are to be considered as causes of *necrosis*. They may be either *external*, as mechanical violence, tearing of the *periosteum*, exposure of the bone, particularly if it be long subjected to the influence of the air, or be treated with acrid irritating remedies, contusions, and so on; or *internal*, in which may be included all the dyscrasic diseases already mentioned (*par.* 863) from whence inflammation and death of bone arise. The external causes rather produce *necrosis* of the external layers of the bone, as the internal causes do internal *necrosis*. Oftentimes both causes operate together.

["If the *periosteum*, which, by its own vessels is in most intimate connexion with the vessels of the bone, be destroyed to any considerable extent, the external layer of the bone (not its whole thickness) dies," says MÜLLER (*a*), "because the vessels of the outer layer are rendered useless by the destruction of the *periosteum*. If the medullary tissue alone be destroyed by inflammation, or artificially in an animal's bone which has been sawn through, the inner layer (not the whole thickness) of the bone dies, because the vessels of the inner layer of the bone are in the closest connexion with the medullary vessels. Now the process which ensues, in internal *necrosis*, in the still living external part of the bone, and in external *necrosis* in the still living internal part of the bone, is remarkable: it becomes inflamed to the extent of exudative effusion, as in an inflamed fractured bone, and subsequently the effused matter, as in that case, becomes organized and ossified. If the bone be injured externally and there be an outer *necrosis*, the exudation takes place within the cavity of a tubular bone, and the medullary cavity is thereby diminished. This callus on the interior of the cavity of a tubular bone

(*a*) Physiologie des Menschen, vol. i.

strengthens its walls, of which the outer layer is dead. If, on the other hand, the *medulla* of a sawn-through tubular bone be destroyed, in consequence of which the inner layer dies, the exudation takes place on the outer surface, from the external still living layer of the bone. Most writers have not distinguished the swelling of an inflamed bone, called by SCARPA its *expansion* from the deposition of bone following the exudative condition, in the former case into the medullary cavity, and in the latter on the external surface between the *periosteum* and the bone. The exudation is a process continuing only for a certain time, but the swelling continues during the whole period of the inflammation, and first appears distinct when the bone softens and becomes very vascular opposite the necrosed piece. This expansion of the inflamed and softened bone, in the *mammalia,* plays the principal part in the regeneration of the necrosed piece of bone. At the part where the healthy external layer touches the internal necrotic, or where the sound internal layer touches the dead external, the still living inflamed bony layer is quite soft, red, and granulating, and in internal *necrosis* increases externally, whence, however, no new tube is formed around the internal necrotic layer, (*sequester,*) but a strengthening of the outer layer, or beneath the external separated necrotic layer, a strengthening of the internal layer ensues, both externally as well as towards the medullary cavity. This swelling proceeds whilst the surface of the inflamed and softened bone begins to suppurate, either internally opposite the internal *necrosis,* or externally opposite the external *necrosis.* If the whole thickness of a bone be dead, no bone is regenerated; the *periosteum* has nothing to do with it; on the contrary, regeneration ordinarily takes place when merely the outer or inner layer is destroyed; here, however, no new bone is formed, but the dead portion of the tube in internal *necrosis* is only the inner layer of the tubular bone, and the new tube around the dead is only the strengthened and swollen outer layer of the tubular bone." (p. 403, 404.)

Of *necrosis* produced by irritation, two very remarkable instances may be here mentioned. BROMFIELD'S (*a*) case, in which the pea of an issue slipping frequently out of its bed, was confined by "a compress with a shilling in it bound very tightly; this, by its pressure, soon destroyed the *periosteum,* and not long after made its way through the surface of the bone into its spongy parts. Though a deep bed was thus obtained for the pea, yet violent pain and great swelling of the knee ensued; by throwing out the pea and dressing the bone properly a large piece of the spongy substance came away and the sore healed." (p. 10.) In the case referred to by LAWRENCE, "the patient had received a slight injury over the *tibia,* the sore put on the appearance of sloughing *phagedæna* or gangrene, and the concentrated nitric acid was applied to it. It appears that the acid affected the *periosteum* of the bone, at the part to which it was applied, and inflammation and *necrosis* of the *tibia* were the consequence." (p. 361.)]

870. The inflammation preceding *necrosis* has either an acute or chronic course, and is accompanied with more or less severe symptoms. If the inflammation be seated within the bone, there is first produced violent deep-seated pain, not increased by motion nor pressure, and frequently accompanied with severe fever, and exhausting perspiration; a hard swelling appears, which gradually spreads, and over which the skin is neither tense nor red. After a longer or shorter time, according to the severity of the inflammation, abscesses form in different parts, which burst and discharge *pus,* without the swelling being diminished. These openings often correspond to the position of the diseased bone, often they form, especially if the bone be covered with much soft parts, fistulous passages, of which the external openings are surrounded with a wall of flesh, a line thick; some of them close and others again break out.

["When the ossific inflammation is not cured," says JOHN HUNTER, "suppuration takes place, first, on the surface of bones or on the *periosteum;* secondly, in the substance; thirdly, (p. 508,) in the medullary parts. * * * The *first species.*—When inflammation attacks the surface of a bone, the first effects are adhesive; and when suppuration takes place, the *periosteum* is separated as far as the suppuration extends, making underneath a cavity for the matter. As the adhesive states take place some way round the abscess, there is in many cases a circle of adventitious bone formed in the *periosteum* round the abscess. * * * Often, from the separation of the *periosteum,* part of the bone dies, and must exfoliate. The *second species* is of greater consequence, as more of the bone

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(*a*) Chirurgical Observations and Cases, vol. ii. London, 1773.

becomes diseased. When inflammation attacks the substance of the bone, it is seldom that the whole diameter of the bone swells, generally only one side, where the suppuration is. This must at first be much confined, from the solid parts around, and ulcerative inflammation is obliged to take place early; and accordingly, as in common abscesses, the ulceration goes on towards the soft parts, and until it arrives there it is impossible to tell whether there is abscess in the bone or not. * * * The *third species.*—Inflammation in the medullary part is still more serious in its consequence than the last. The body of the bone thickens from the adhesive disposition, and also the ossific disposition takes place in some degree in the *periosteum* all round, so that the external parts are much increased in bulk: this only takes place in the bones of the extremities, where streng this necessary, and never in the scalp, &c. The ossific disposition in the medullary parts takes place at all points of the abscess, and by this the other part of the marrow is saved. When suppuration takes place, there being no vent obliges the ulcerative inflammation to take place. * * * In the two last mentioned we have often exfoliations, as well as in the first (species); but they are less favourable from their situation being different, and are called internal exfoliations." (p. 513–15.)]

871. The *diagnosis* is more certain, if the piece of bone be apparent in the aperture of the ulcer and be black; but if it be white and dry, the previous symptoms and the duration of the disease must decide whether it be exposure or actual death of the bone. In all cases, examination with the probe or with the finger, if the size of the aperture will allow its introduction, with which the dead bone is sometimes felt to be movable, affords sufficient information. If the previous symptoms have been slight, it is probable that the *necrosis* is superficial. This may be presumed with more certainty, if the earlier swelling have not spread to the whole extent of the bone, and the pain be more superficial. The size of the dead piece of bone is determined by the extent of the swelling, and the distance of the orifices of the fistulous openings from each other. If there be several dead pieces of bone at the same time, they are felt on examination by the several apertures at different places, and a swelling answering to each of them is observed. The corresponding fistulous apertures also do not heal, although some pieces of bone have been removed; they often, however, do not heal after the complete removal of the dead pieces of bone, because they go very deeply, and considerable suppuration occurs. Ill-conditioned, stinking, blackish *pus* is no certain sign of *necrosis;* on the contrary, the suppuration is mostly good, and only degenerates when the general health is disturbed.

Although *caries* and *necrosis* are alike in many symptoms, as in the two diseases similar causes give rise to both, as the bones are laid bare by the removal of the soft parts, and less or greater portion of the substance of the bone is lost and suppuration is present, yet they are distinguished by the following circumstances:—*Caries* occurs especially in bones of a spongy texture, *necrosis,* on the contrary, in bones of a closer character; in superficial *caries* the swelling has not at first so great extent as in bony gangrene; the swelling in *caries* mostly opens itself to a greater extent, fistulous passages often occur which become callous; in *necrosis* these openings have ordinarily a fleshy wall; in *caries* stinking *ichor* flows, but in *necrosis* true pus, which is only bad when retained too long by improper treatment, or when the neighbourhood is much irritated, or when *caries* also exists; in *caries* there are vital appearances, injection of vessels, loosening up, suppuration and successive destruction, therefore is the touch of the probe painful, whilst the necrosed bone is insensible and pain is only produced by harsh touching, and which spreads to the sound parts; the softening which accompanies or precedes *caries* extends further and loses itself imperceptibly, and above all, where it exists the bony cells are filled with reddish fluid; in *necrosis* it is developed in sound parts, is less extensive, and produces only one layer of granulations, which are formed between the healthy and dead parts; the fungosities of a carious bone are softer, grayer, more discoloured than those above and below a piece of the necrosed bone, and the latter have more of the appearance of the granulations of a suppurating wound; in *caries* the bone is rough, uneven, soft, broken up, fungous, and the probe easily penetrates it; in *necrosis* the bone is even and hard, and though rough, not, however, yielding and soft; the bony splinters thrown off are in *caries* small, dust-like, and destructible; in superficial *necrosis* they are layer-like, in deep *necrosis* large, firm, and of the natural condition of bone; the *periosteum* or medullary membrane is in *caries* usually much changed or destroyed, whilst the one or the other or even both in *necrosis* preserve their integrity, therefore nature does little in *caries;* in favourable cases the openings become callous, and similar changes are produced in the bony substance, or granulations arise from the bone which become connected with those from the soft parts but are rarely converted into bone and form only misshapen masses, whilst in *necrosis* a more or less complete reproduction of the destroyed bone is effected. The course of *necrosis* is mostly tedious, but often also quick and connected with active inflammation, which is rarely the case in *caries.* After opening the abscess, the pain in *necrosis* usually subsides, whilst in *caries* it mostly increases (*a*).

The notion that in *caries* the organic principle (bony gelatine) has entirely disappeared, and instead of it a peculiar fatty matter produced which fills the cells of the carious bone, whilst in *necrosis* the formative principle remains unchanged and its respective relations, that is, as they are found in health, remain, (DELPECH, BÉRARD, POUGET and others,) is not confirmed by MOURET's experiments (*b*), as, according to him, the fatty matter in which every writer believed, is always found in recent *caries*, well distinguished from rancid fat by its smell, which may serve as its characteristic; but all the bones he examined have a fibrous jelly-like substance, and contain a proportionate quantity of saline substances, as in healthy bone; it is therefore impossible by the chemical characters indicated to distinguish *caries* from *necrosis*.

872. Nature endeavours to separate a piece of dead bone, usually called a *sequester*, from a healthy bone, by the process of absorption, which at the line of connexion between the dead and the healthy bone, produces a loss of substance (1). As long as the exfoliation goes on by absorption and granulation, the small fleshy wall surrounding the fistulous opening remains, according to DZONDI's observations, unchanged; but it shrivels as soon as that process is completed, and the separated piece is thrown off externally, at the same time the previously very small round hole becomes irregularly enlarged. After this separation of the *sequester*, its expulsion is possible, and usually happens without hindrance, excepting such as the soft parts offer, if the dead piece belong to the external surface of a flat or tubular bone. Compensation for the lost piece of bone is effected by nature in various ways. If the *necrosis* extend only to the external layer of the bone, whilst the internal remains alive, which happens only in slight injuries from mechanical influence, abscess and the like, the piece of bone, if the *periosteum* and soft parts remain uninjured, is enclosed in bone newly formed by the *periosteum* and is separated within by the granulations formed from the living layer. The piece of bone exhibits a rough surface, produced by absorption. If the *periosteum* and the soft parts be destroyed on the affected parts of the bone, and it is bared of soft parts, or entirely separated from them by blood, suppuration, and the like, the granulations arising from the compact bony mass can only effect imperfect compensation, so that a depression or deficiency remains at the place of loss. Here the piece of dead bone keeps its smooth surface and its whole thickness. In every severe inflammatory irritation of the surface of the bone, there occurs a corresponding plastic activity in the medullary canal, and new bone is produced, which, opposite the point of greatest irritation, fills up the medullary cavity. In internal *necrosis*, if the layer of bone concealed within the medullary canal die, the compensating substance is formed from the *periosteum*, and becomes one with the external layer of the cortical substance, which remains healthy, excepting that the latter swells and

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(*a*) RICHTER, above cited, vol viii. pt. i. p. 128.—Dictionnaire de Médecine et Chirurgie Prat., Article, *Ostéite*.

(*b*) Révue Médicale, 1835.

softens, and thus assists in repairing the loss. If the whole thickness of the bone die, new bone is formed by the *periosteum* around the old, and the latter is diminished by absorption, in consequence of the increased vascular action and sympathy with the *periosteum*, and thereby its bulk is lessened, in proportion as the formation of the new bone from the *periosteum* proceeds. If a portion of a tubular bone with the investing *periosteum* be destroyed and separated, the compensation results less from the opposite ends of the bone than from the soft parts. The granulations filling up the interspace gradually thicken to a cartilage-like mass, in which subsequently ossification follows. In the capsule which surrounds the *sequester*, openings (*cloacæ*) are produced, the origin of which is not yet sufficiently made out, of various form, size and number, which communicate with the fistulous passages in the soft parts.

The reproduction of bone does not depend on the *periosteum*, but only on the softened and outstretched tissue, which naturally close set, forms the thick texture of the bony walls.

[(1) "*Necrosis* and *exfoliation* are not," justly observes LAWRENCE, "synonymous expressions. When a portion of bone has perished, has become mortified or gangrenous, it is separated by a natural process from the healthy portion of the bone; and that separation, under certain circumstances, is called *exfoliation;* so that exfoliation is consequent on the *necrosis;* that is, the necrosed or mortified or dead portion of bone exfoliates or separates. Exfoliation is, therefore, a subsequent process, consequent on the previous death or *necrosis* of the bone." (p. 360.)

The term *exfoliation* commonly applied to the separating sloughs of bone, in consequence of their occasional leaf-like form, is not improperly objected to by WEINHOLD, who observes, that "as much more frequently the sloughs assume other and very different forms, it is evident that this designation is not quite fitting, but that it would be better to call it *separation*, by which would be more correctly expressed what was intended to be said." (p. 22.)

At least as early as 1786–7 (*a*) JOHN HUNTER observed:—"We have many opinions of this process (exfoliation) from different authors, but all are very imperfect. The bone that separates cannot come away by rotting, for it is only dead, and not in the least putrefied. * * * When a piece of bone becomes absolutely dead it is then to the animal machine as any other extraneous body, and adheres only by the attraction of cohesion to the machine. The first business of the machine, therefore, is to get rid of this cohesion and discharge it. For effecting this separation there are several natural and successive operations. The first effect of the stimulus is on the *surface of the living bone*, which becomes inflamed; whether new vessels are formed, or the old ones become larger, is undetermined; but by injecting the surface of the part it appears evidently much more vascular than the other parts. The surrounding parts also inflame, as the *periosteum* and cellular membrane often take on ossific inflammation. This produces another process; first, absorption of the earthy matter, and all the surface between the living and dead parts of the bone become as soft as if steeped in acid, while the dead part remains as hard as ever. To complete the separation the absorbents continue their office and absorb the living parts also, and the first process is in a small degree attended with the second. The operation of separation does not take place equally; it begins at the circumference, and continues on to the centre, and before the centre has begun the absorption of the earth the circumference has begun the second. This progressive process in the suppuration causes the exfoliation to be tedious, so that the centre is the last place that separates. In pretty broad exfoliations, long before the centre has gone through the operation, the living parts perform their office in producing granulations from the surface, and continue, in proportion to the waste, to fill up the space." Shortly after, in speaking of the spicula which remains on the exfoliating ring of a trephine-hole in the skull, HUNTER also observes:—"It appears from this last supposed case that it is my opinion that the absorption is of the surface of the living bone, but I by no means wish to be understood that no absorption of the dead piece can take place; for, on the contrary, I believe that nature sometimes finds it necessary to the completion of her pro-

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(*a*) The date of the copy of notes from which PALMER has published his edition of HUNTER's Lectures on the Principles of Surgery.

cess; it generally takes place when the separation is slow and the granulating process is quick. This absorption of the dead bone takes place in the fangs of the shedding teeth." (p. 525-27.) This extract proves that **John Hunter** had taught the true nature of the exfoliating process at least six or seven years before the publication of **Weidmann's** work on *Necrosis*. And it is very remarkable how nearly the expression of **Weidmann's** opinion on this subject corresponds with **Hunter's**. "The actual cause," says he, "of that separation consists in the removal of those adjacent and cohering particles between the living and dead part, in such way, however, that the greater portion is removed from the living and some from the dead part." (p. 25.)

"The first appearance of separation," says **Hunter**, "is an alteration in the part round the exfoliating piece. This alteration is first a sponginess; next, its becoming fuller of little holes; then a small grove is produced, a kind of worm-eaten canal about the thickness of a shilling, becoming gradually deeper and deeper, and the depth is irregular, according to the extent of the original cause. The small holes appear at first in the surrounding parts, and these appear more vascular the more so the nearer the diseased bone. Sometimes parts become dead without any change of colour, dying almost suddenly, perhaps by exposure or a blow, and the surrounding parts become spongy; the dead portion then looks the soundest, but when killed by previous diseases it is black. After exfoliation the living surface still continues soft until bone is formed. If it be a cylindrical bone it has the appearance of a *fœtus's* bone deprived of its *epiphysis*; it is hollow, but fills like a growing bone, in every respect, by bony matter deposited." (p. 527.)

The subject of exfoliation has been well gone into by **Miescher**, and it is interesting to observe how completely his experiments and observations confirm **Hunter's** statements.

"For the first few days," says **Miescher**, "it is not possible to determine how far the *necrosis* extends; although the colour appears changed on the external surface, yet it so gradually subsides into the healthy colour of the bone, that it is impossible certainly to define the boundary between them. Gradually, however, there appears a certain thinning of the bony tissue, the medullary canalicules seem here and there enlarged, so that a sort of *diploë*, as it were, is produced, the cells of which are filled with a kind of soft reddish substance. The walls of the cells become daily thinner and thinner, till at length they entirely disappear, so that the living and dead bone are no longer connected by bony substance; the necrotic part now alone adheres by a few very delicate fibres to the soft substance I have mentioned, and is movable, but at length these fibres either subside of their own accord, or are easily separated; which done, the exfoliation is completed, and the bone appears covered with a layer of that soft substance, or with granulations. These changes do not take place at the same time in the necrotic piece, but first at its external edge forming the so-called *groove*, and thence by little and little pass on towards the centre. Hence it appears that in the part where the dead and living bone touch, absorption of the bony substance is taking place, proceeding as it would seem from the medullary canalicules and thence gradually breaking up the cohesion between the dead and living bone, till at last it is completely destroyed. The gaps, moreover, as they are gradually formed, we perceive to be filled with soft substance, which, when the separation is perfected, covers the bone sometimes with a thicker, sometimes with a thinner layer, secretes pus, and rises into granulations. Many have considered this to be softened bone; but this doctrine agrees neither with the production nor structure of that substance, for following it out from its beginning, we find, as already noticed by that very able and diligent observer **Troja**, first, a reddish matter, little tenacious, almost gelatinous; subsequently when it has become somewhat firmer, we perceive, by the aid of the microscope, a structure similar to granulations, such as are on soft parts; not, indeed, like the cartilage of bones, which ought to be found, if this matter be taken for softened bony tissue, that is, deprived of its earthy parts. Therefore is it believed to be recently formed, precisely as every kind of granulation; which opinion, its very nature, afterwards, especially favours.* * * What has been here said in regard to superficial *necrosis* and the external powers, applies to every kind of *necrosis*; which from whatever cause arising, whether it attack the external or internal surface of the bone, or its whole mass or only part, always presents in its exfoliation the same phenomena, and always when separated, leaves the surface of the bone covered with granulations and secreting pus. (pp. 200, 201.)

Upon the disputed question whether in the separation of a *necrotic* piece of bone there be any absorption of the dead portion, or whether the absorption be confined only to the living bone, **Miescher** declares himself a supporter of the latter opinion. "I have already observed," says he, "that at the same time the groove began to form around the *necrosis*, the thin edge of the bent plate was somewhat bent down by the just growing granulations and that it wasted away in minute scales. I was able to follow this out, as it were, step by step, by observation in *necroses* produced by baring the surface of bones in rabbits, cats, and in the calf, in which, throughout the whole proceeding, the wound remained dry; the little scales, separated in the crust covering the lips of the external wound, could be most distinctly demonstrated; which crust having been cautiously removed, the very thin edge of the dead plate appeared as it were corroded, and a lancet being introduced beneath it, very readily fell into minute particles. Small particles, therefore, having separated, it seems, like scales, the *necrotic* plate gradually diminished to sometimes more than half its size; nor was it doubtful, that in the cases mentioned by **Ruysch**, **La Peyronie**, and **Rouhault**, the dead piece of bone thus by degrees entirely disappeared. This *exfoliation in particles* might be more difficult to demonstrate in those cases in which the wound is constantly moist with pus and poultices, and the thin plate is as yet perhaps dead; but, when the other phenomena do not at all differ, and absorption by a *solid* lifeless body seems opposed to the very laws of physiology, and when there is no fluid, by the solvent power of which it can happen that the dissolved dead bone should be absorbed,—we cannot, even in these cases, though more doubtful, but think that the *exfoliation by particles*, or *insensible exfoliation* is performed. In addition to this, the acute **Tenon** says, that in the experiments he performed on dogs, he always observed, that the granulations which sprung up from the bared surface of the bone, as soon as they made their appearance, were covered with a minute crust, which might justly be considered as bony scales separated and thrown off by the granulations. Every support is, therefore, torn away from the opinion of those who, in the separation of *necrosis* by absorption, consider that something is taken away even from the dead bone; and we can now certainly contend, that the *necrosis is separated by absorption occurring in the living parts alone;* which is of no little moment for rightly understanding the reparation of bones destroyed by *necrosis*." (p. 207–8.)

I cannot agree with **Miescher** that absorption takes place only in the living parts during the process of separating a *sequester*. **Hunter**'s opinion is certainly correct, "that nature sometimes finds it necessary to the completion of her process," that there should be some absorption of the dead bone and that "it generally takes place when the separation is slow, and the granulating process is quick." I think that absorption of both dead and living part of the bone occurs most commonly in all external exfoliations; but of its almost invariable occurrence in exfoliations of the bones of the head there can be no dispute; for not merely is the under surface of the exfoliated piece hollowed in correspondence with the granulations beneath, but it rarely happens that there are not two or three regular holes eaten completely through both tables of the bone, with fungous growths from the *dura mater* protruding in the latter case, or the granulations alone in the former.—J. F. S.

The following is the account given by **Troja** of the incipient production of new bone seven days after the shell of the shank-bone of a pigeon had been killed by sawing the bone through and breaking up its medullary structure with a probe. "Having killed the pigeon on the seventh day, I was astonished, on removing the muscles, to observe the very great thickness of the shank-bone, which in comparison with the opposite healthy bone was enormously thickened. On examination I found fresh bone newly produced around the shank-bone. On separating the *periosteum*, which was every where a little swollen, except at the lower end, where it was swelled up with a dense or semi-cartilaginous jelly, blood-vessels were evidently perceived entering into the substance of the new bone. When I divided this bone lengthways into two parts, the new bone, now divided, dropped, almost of its own accord, into two equal portions, from both sides of the old shank-bone. Surprised at the speedy separation of the new from the old bone, I endeavoured to ascertain the cause. Therefore carefully viewing the internal surface, I perceived a certain softer substance, and by bringing the point of my knife to the side of the bone, the membrane seemed to me to be lifted up. Struck with the novelty, I gave my attention to it; I inverted a true, entire, very juicy and thickish membrane. Whilst this was separated from the bone, which was very easily done, an almost infinite number of very delicate membranous threads were seen to draw out, which proceeding from the little apertures spread over the inner surface of the bone, were inserted into the membrane itself. Its ground colour was white, and transparent when raised against the light, but it was tinged and almost covered with very numerous red streaks, or, if you please, with an almost infinite number of spots collected together, but much less numerous at the lower end of the bone, which was also white. It well resisted pulling, nor did it dissolve, nor lose the characters of membrane when strongly rubbed with the fingers; but it was not to be considered as strong as *periosteum;* for as yet it had less cohesion. The substance of the new bone seemed spongy, and tinged every where with the red colour of the blood, except the lower end, which, as already said, was rather whitish and softer. When this substance was cut out and its thickness pressed with the fingers, a few drops of blood and lymph, like a scanty dew, exuded. (p. 21–24.) Its internal surface was furnished with an infinity of little holes, as well as the external; nor was the hole in the middle and outer side of the shank-bone for the passage of the vessels deficient. There were also some very large holes, which penetrating from the external to the internal surface of the bone, were covered without by the external *periosteum,* and within with the internal membrane; they contained a dusky whitish and dry crust; whence it was very clear that they originated in a defect of the ossification. I shall name them *foramina,* or *grandia foramina.*" (pp. 27, 8.) **Weinhold** says, that these holes, "as they give passage to the escaping pus and the loose pieces of bone, would be better called *cloacæ.*" (p. 35.) "Beginning from the sixth hour and going on to the seventh day," says **Troja**, "I did not perceive in the new bone, these spaces and *grandia foramina,* except when the legs were swollen, and then they were constant. In the twice that I proceeded to the seventh day, I did not make out whence were these spaces and *foramina.* At first I thought they were the insertions of muscles; but their irregular situation and uncertain number, one, two, and even to eight, and more careful examination, proved to me that such was not the case. Their absence in legs which had not swelled, and the *periosteum* raised from the bone in vesicles, assured me that no jelly could be collected in the spaces, and that the *foramina* in the bone must be produced by want of substance or of ossification. But it might be conjectured that the dry crust in them originated in the juice which the broken vessels poured out, drying on the surface of the torn *periosteum,* and perhaps from some layer of it which was dead." (pp. 58, 9.) **Weinhold** says he has "seen a small portion of dead *diploë* of the *os innominatum* contained in a bony cavity without any *cloaca.* If there be many cavities in the same bone containing *sequestres,* each has at least its own *cloaca.* * * * Their form is round or oval, or somewhat like; their size is commonly sufficient to admit a quill; there are however some larger, though rarely so. Inwardly their edges are converging, and as it were contracted like a funnel, but outwardly their lips spread downwards, and the intermediate passage is sometimes long, sometimes short, and sometimes scarcely existing." (p. 35.)

Upon the disputed point, whether the newly formed bone inclosing the *sequester,* in internal *necrosis* be produced by the swelling of the outer layer of the bone, or from the investing *periosteum.* **Müller** observes:—"It is not in itself conceivable, that a membrane like the *periosteum,* which is merely the vehicle for the vessels entering into the bone, and also its covering, should form an organized mass of bone. (p. 405.) It is a most entire misconception, to suppose that one organic part can be the nourishing organ of another organized part, for instance, that bony substance should be produced by *periosteum,* and that bone should be nourished by that membrane. * * * Bone is nourished by vessels from the *periosteum* and medullary membrane; it therefore dies if either of these be destroyed to some extent, the external layer on the destruction of the *periosteum,* and the internal on that of the medullay membrane. But it does not follow that these membranes deposit the lime in bone. The *periosteum* is the vehicle of the vessels penetrating the bone, which therefore dies when they are torn through at that part. The nourishment and growth of bone depends on the sympathy of the bony particles between the capillary vessels and the blood. (p. 361.) But it can be distinctly shown by experiments on beasts, (which for this purpose are better than birds,) that the formation of the new tube is partly effected by the exudation, during the exudative stage, upon the surface of the bone, which is to be viewed as exudation from the inflamed bone, and not from the *periosteum,* but that the greater part of the bony mass is alone formed (in internal *necrosis*) by the spongy swelling of the external layer which continues during the whole period of suppuration." (p. 405.)

Lawrie of Glasgow (*a*) in treating on the subject of *necrosis,* asks:—"What part does the dead bone play in this process? does it act as a stimulant to the deposit of ossific matter? does it serve as a mould for the new bone? if it were removed, would the process be arrested? To all of these questions I would reply in the negative. I do not think that the presence of dead bone is more required to assist in any of the processes involved in the above queries than the presence of a slough of the soft parts in the generation of

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(*a*) Cases of Necrosis, with Remarks; in London and Edinburgh Monthly Journal of Medical Science, vol. iii. 1843.

new flexible tissues. When the entire thickness of a cylindrical bone dies, the first step towards regeneration consists in an attempt to get rid of the dead part, by the absorbents forming a groove around the dead portion, gradually cutting it through and isolating it from the living. The next step, to a certain extent contemporaneous with the first, is the deposit of new osseous matter all around this groove, springing from the bone; the last, is the surrounding of the old bone with new, which begins to form before the old has separated, and continues after the connexion of the two has been quite dissolved. CURRIE's case (one he relates) appears to me to entitle us to answer the second and third queries in the negative; the old bone was removed long before the new was deposited; the process so far from being therefore arrested, was greatly accelerated, and the form of the new bone was much more symmetrical than if it had been deposited slowly around the old as a mould. It may be asked, if this view of the matter be correct, why is it not thrown off as is a slough of the cellular tissue? I believe that the impediments to its escape are mechanical and not physiological (physical?); the soft parts which cover it, the irregular line in which it dies, and the vitality of the cancellous structure next to the *epiphysis* extending for some distance within the dead outer case, render its escape impossible long after its presence has become a source of retarding, it may be, of fatal iritation." (p. 684.)

" So soon as any bony part, in which there has been previous sensible or insensible exfoliation, is covered with granulations, the process," says MIESCHER, "is the same as with another suppurating wound: the same *pus*, the same granulations. These having attained the height of the granulations of the surrounding soft parts, coalesce with them and as it were become one; after which the scar is covered in the ordinary way. That part of the granulations immediately next the bone, is converted into bony substance; but the exterior layer is not so changed, but like the granulations of soft parts has a cellular structure, and thus as it were forms a new *periosteum*." (p. 208.)

JOHN HUNTER observes:—"There can only be two species of exfoliation, *viz.* external and internal, but they are often mixed, and then admit of a third kind, which I call the inclosed exfoliation. The *external* arises from internal causes, and is in many parts a simple operation, meeting with no obstructions, as in the head, ribs, &c.; but in the extremities it is often complicated, and becomes inclosed, and then appears as an internal exfoliation. *Internal Exfoliation.*—These less frequently arise from accidents than the former; but may arise from the two last suppurations of bones (of which, the one is where only one side of the bone suppurates, and the other where the suppuration is in the medullary cavity.) The part which is to be exfoliated loses its life, and ulceration goes on in the internal surface of the surrounding living bone to make room for the exfoliation. In internal exfoliations a part of the centre of the bone becomes dead, while the enlargement of the cavity lessens the substance of the surrounding part, and consequently weakens that part. But nature wishes to furnish a substitute; for the stimulus of weakness being felt, the surrounding parts become affected, and undergo the ossific inflammation by which the bone is thickened; and this continues in proportion, and as long as the internal part is unremoved or not cast off. *Mixed Cases of Exfoliation.*—The first is when an external one appears to be internal; the second is an exfoliation of the whole thickness of the bone in one part; the third, of the whole bone. These I call inclosed or incased exfoliations, generally occurring in the lower extremities. These three being very different, at first are not very easily conceived. *First species of inclosed.* Sometimes when the surface of a bone becomes dead, before the separation of the piece of bone takes place, the ossific inflammation comes on, and entirely covers the exfoliating piece, leaving only a little hole for the discharge of matter. This takes place, first, when the *periosteum* is inflamed, and the granulations from the edges of the exfoliated pieces also ossify; but the process for freeing the portion of bone has been already described. The *second species* is when a piece of any given length becomes dead throughout; the appearance of internal exfoliation is here still stronger than in the last case. Exfoliation or separation begins on the living surfaces of contact, at the two ends of the dead bone or piece, and ossific inflammation comes on in the surrounding parts, so that it becomes incased. This rarely happens; but when it does, the separation of the exfoliated piece is very tedious, as the stimulus is given to all surrounding parts. The *third species* is where the ossific disposition takes place in the soft parts, from end to end, and the whole becomes inclosed in a case of bone. The difficulty lies in conceiving how it becomes inclosed at the ends where the joints are constituted; but probably it is from these ends being alive, and exuding coagulable lymph from their surfaces, or else from lymph being exuded from the surrounding ligaments, and that becoming a basis, so as to keep the joint complete." (pp. 529, 30.)]

Upon the reproduction of bone, the following notices are to be especially compared:—

Troja, M., De novorum ossium, in integris aut maximis ob morbos deperditionibus regeneratione experimenta, &c. 12mo. Lut. Par., 1775.

Blumenbach; in Richter's Chirurgischer Bibliothek, vol. iv. p. 107.

Köhler, Experimenta circa regenerationem ossium. Gottingæ, 1786.

Weidmann, Above cited.

Boyer, Traité des Maladies Chirurgicales, &c., vol. iii. 8vo. Paris, 1822–26.

Meding, Dissert. de regeneratione ossium per experimenta illustrata; cum tab. æneis. Lipsiæ, 1823.

Kortum, Dissert. proponens experimenta et observationes circa regenerationem ossium; cum tab. æn. Berol., 1824.

Richter, Above cited.

Scarpa, De anatome et pathologia ossium. Ticini, 1827.

Miescher, Above cited.

873. *Necrosis* is always a serious disease, of which the duration is indefinite. The *prognosis* is, however, various, according to its cause and its seat. Its cure may be hoped for by the natural powers alone, or by simultaneous artificial assistance, if the *necrosis* be superficial, of no great extent, in no bone of important function, not in the neighbourhood of important parts, produced by external causes, and when the patient's general health is good. On the contrary, the cure is difficult, and the *prognosis* is doubtful, if the *necrosis* be of great extent, connected with other affections of the same, or of other bones, if the diseased bone be of great importance, if the *necrosis* be internal or exist in several places; further, if it be produced by internal causes, especially those dyscrasic diseases, against which we have not any decidedly efficient remedy, and if the patient be old and very weak. *Necrosis* rarely extends into joints, but then always require amputation (1). The circumstances which especially produce *sequestres* are different; the granulations arising from the interior of the capsule enclose the *sequester*, which is gradually but completely removed by absorption; or it acts upon the walls of its cavity like a foreign body, and keeps up in it and in the neighbouring soft parts a copious suppuration, which debilitates the patient; or the *sequester* lies in a very spacious cavity, the walls of which have already become callous, and produces no neighbouring irritation, but only a scanty pouring out of a thin purulent fluid (2).

[(1) Of *necrosis* indirectly affecting joints, and in which from the symptoms it was presumed that the joint was diseased, and the limb consequently removed, I have known two instances, both of which are in the museum at St. Thomas's Hospital. In the one, a boy of ten or twelve years old, the necrosed piece, about the size of a marble, was contained in the epiphysal head of the shin-bone; in the other the dead bone was nearly similarly placed, and the *cloaca* from it, had opened into the knee-joint.

(2) Other, and very dangerous consequences may attend *necrosis*, as the very remarkable case mentioned by Porter (*a*), which he calls "*Aneurism* in a case of *necrosis*," but which was doubtless no other, than a wound of the popliteal artery, by the accidental movement of the point of a *sequester*. The patient had, fourteen or fifteen years previously, violent pain in the left knee, which, as well as the lower part of the thigh, shortly after swelled to a great size, but without redness. A year after, a small swelling appeared four or five inches above the inside of the knee, which he himself opened and voided some matter, and the aperture remained fistulous. In August 1832 he had an alarming hæmorrhage from this fistulous opening, but no recurrence of it till the night of Jan. 1, 1833, when he bled with great violence, the blood at intervals spirting

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(*a*) Surgical Report of Cases treated in the Meath Hospital; in Dublin Journal of Medical and Chemical Science, vol. v. p. 190. 1834.

forth to a considerable distance, at others trickling down the limb, but in neither case restrainable. He lost great quantities of blood, and fainted seven or eight times. When admitted on the following day his face was quite blanched and very anxious; he was extremely exhausted; pulse small, thrilling, and 150. On pressing the small livid fistulous opening in the thigh, thin serous blood slowly discharged, and the finger seemed to sink into a deep cavity; pulsation was quite distinct in the swelling; the lower part of the thigh-bone was enlarged, and the popliteal space filled up, but the artery was felt pulsating below. Amputation was proposed, but he would not consent. The thigh continued swelling above the bandage, became gangrenous nearly up to the buttock, and he died on the evening of the 6th of January. On *examination* the popliteal space was found filled with thick grumous clots; on the artery, just below its entrance into the space, was an opening. The lower part of the thigh-bone was considerably enlarged, rough, and a large portion of its posterior or popliteal aspect destroyed, so as to admit the fingers into a large cavity within. In the upper part of this cavity was discovered the sharp point of a *sequester*, movable, and accurately corresponding to the aperture in the artery, which it evidently seemed to have occasioned.]

874. In the *treatment* of *necrosis*, nature must be assisted in throwing off the *sequester*, which is then to be removed. If at the first there be severe pain, inflammation and fever, it must be attempted to lessen them by general and local blood-letting, according to the strength of the patient, by softening poultices and the like. If *syphilis*, gout, or other dyscrasic dieases be connected with *necrosis*, the contraindicated remedies must be made use of. Where the general condition of the patient is good, and the *necrosis* originating from external causes, the separation of the *sequester* usually occurs soon, provided nature have not been disturbed by improper treatment. If the patient be well, his powers must be supported by good nourishing diet and strengthening remedies. The *local treatment* must be quite mild; moist, warm, slightly aromatic applications should be used, as in *caries*, and the fistulous openings covered with charpie, soaked in mild ointments.

All irritating treatment to promote the throwing off of the *sequester*, as the enlargement of the fistulous apertures, the application of sharp spirituous remedies, the actual cautery, the repeated boring of the dead piece of bone, are hurtful, inasmuch as by their effect on the living part they increase the destruction, but on the dead bone have no effect at all (*a*).

875. When the *sequester* has separated, which is known, on examination, by its mobility, it is not unfrequently thrown out by nature, or gradually removed by absorption. But if, on account of its peculiar position, on account of the surrounding soft parts, or of the bony capsule enclosing it, this be not possible, the *sequester* must be removed by art. For which purpose, oftentimes a simple incision of the soft parts of sufficient size is alone needed; if the *sequester* be enclosed in a bony capsule, after exposing it by a longitudinal incision, the apertures must be enlarged with a bistoury, if the bone be soft enough; boring the capsule with the trepan, or the removal of a portion with chissel and hammer, or with Hey's saw, may be required. The *sequester* is then to be seized with the forceps, or with the fingers, and gently drawn out, especial care being taken that none of it be left behind, and that the inner wall of the bony capsule be not injured. If the *sequester* be so large that a considerable opening is required for its removal, it is often better to break it to pieces with the forceps, so as to be able to remove it by a small opening. After its removal, the wound is to be lightly filled with charpie, everything removed which can disturb the development of the granulations, and care taken for the sufficient outlet of the *pus*.

(*a*) Weidmann, P. above cited.

876. If the *necrosis* have been of long continuance, if the outflow from the fistulous openings be slight, if the *sequester* cannot be felt, if already several pieces of bone have been separated, the *diagnosis* is doubtful, whether there still exists a *sequester*, or whether it be not already removed by absorption. In this case the laying bare or boring through the bone is useless, and it is advisable to watch the state of things for some time, with simple treatment, in order to decide with certainty upon the diagnosis.

877. Amputation is only indicated in *necrosis*, when the cavity in which the *sequester* lies communicates with a neighbouring joint when there are several *sequestres*, of which each has its proper cavity, when the *sequester* lies so deep that its removal is not possible, and when the patient's powers are so sunk that throwing off the *sequester* cannot be expected, or its removal cannot be undertaken without the probable danger of exhausting the patient.

A.—OF CARIES OF THE SKULL-BONES.

878. *Caries* may occur in all parts of the skull, though it is most commonly observed in the mastoid process and in the occipital bone. It occurs either on the external or internal table of the skull; in the former case it arises either from external violence, exposure of bone, and so on; or as consequence of a *tophus*, or of an *exostosis* which has run into suppuration. The *caries* may be also distinguished by examination. In the second case severe symptoms are sometimes produced by the collection of pus between the *dura mater* and the skull. The patient complains of a constant pain, always confined to the same spot, though externally nothing is apparent. Frequently giddiness, convulsions and *coma;* in short, all the symptoms of pressure on the brain come on. At last there appears externally, at the part where the patient has complained of pain, a slightly painful, and from the first, fluctuating swelling. If this break of itself or be opened, an aperture is found in the skull, of which the edge is thin and irregular, because the destruction of the internal extends further than that of the external table of the skull, out of which by the motions of the brain, a more considerable quantity of pus is driven up than from the external extent of the ulceration would be thought possible. The *dura mater* is covered with discoloured granulations, often depressed, and separated to a greater or less extent from the skull, often even ulcerated. If the *caries* be in the mastoid process, hearing is almost always destroyed; in consequence of the communication of the cells of this process with the ear-drum, the *pus* sinks into it, and produces suppuration and destruction of the drum-membrane.

[The consequences of *caries* or *necrosis* in the mastoid process are very often fatal, and therefore the disease should be most carefully attended to. Most commonly it seems to begin with common ear-ache; abscess of the drum ensues; its lining is destroyed, and the bone either ulcerates and is gradually destroyed, towards the cavity of the skull, or dies outright and attempts are made to throw it off. I do not know any mode of distinguishing between simple chronic suppuration of the ear-drum which is occasionally accompanied with pain. and the suppuration accompanying *caries* or exfoliation; nor is there any distinction between the latter two, from either of which, however, the irritation set up on the *dura mater* may produce inflammation, ulceration and suppuration of that membrane, which consequently attack the brain, and either ulcerates its surface or produce, by remote sympathy, abscess in its substance, of which I have seen instances; and in the last case I had of this kind, the abscess was as large as a pigeon's egg, but the young woman had no symptoms of compression till about three or four days before she died, though at intervals, for some time before, she had suffered agonizing headache in paroxysms of several hours.

When the vault of the skull is attacked with *necrosis*, not unfrequently very large portions of bone die, as does also the scalp covering it, excepting at the circumference of the dead bone, which the skin still overlaps and seems as it were folded in. When both tables of the bone die, which, as far as I have had opportunity of observing is most common, though not to equal extent, as in general the external table is more largely destroyed than the internal, suppuration begins between the bone and the *dura mater*, and if near a suture, the pus makes way between its teeth and is seen welling up at every pulsation of the brain. By degrees the granulations formed on the surface of the *dura mater* eat away holes of various size *through* the dead bone, and funguses appear, which, however, rarely exceed externally the size of the aperture. But on removing the dead bone, very large funguses are found on the *dura mater*, and in the course of a few hours, when freed from the pressure, rise above the surface of the scalp, sometimes to the size of half a split egg. These funguses are generally very foul, sloughy, blackish, green-coloured and horribly offensive; and when of large size the patient generally sinks with symptoms of inflamed brain. Instances do, however, happen in which enormous portions of the vault of the skull do separate, and the patient recover; I have at this time under my care a woman, who in the course of the last eight or nine years has lost by exfoliation, the greater part of both parietal bones, and some portions of the temporal and occipital. All one side of her face supplied by the facial nerve, (*portio dura*,) has been paralysed for many years, though it cannot be ascertained how this is connected with the *necrosis* during the course of which it has arisen. Other portions of the skull have from time to time exfoliated, but after the principal exfoliations, the deficient parts of the skull have filled, as usual, with tough fibrous membrane, and she has been able for four or five years to follow her ordinary occupation as one of the hospital servants. If the external table only have been destroyed, the bony granulations beneath as frequently make holes through it as those from the *dura mater* do through both tables.

Caries occurs also in the bones of the face as well as of the skull, and more especially of the nose-bones, where it is very frequently consequent on lupoid ulceration of the soft parts. I have also at present under my care a boy in whom the upper jaw-bone has been destroying slowly for the last four years from this same cause, and who has lost the greater part of the front of the alveolar arch and of the bony plate, nor has any remedy arrested the diseased process but for a very short time, after which it has burst out again with greater activity.

The disease which results from mercury is *necrosis*, rather than *caries*, whether happening either on the skull or face; and even in *syphilis* except when the bone is affected secondly by the extension of the ulcerative process from a sore in the soft parts, *necrosis* is more frequent than *caries*. Syme (*a*) relates the case of a woman who at the age of twenty years had a sore on her nose, for which she took large quantities of mercury. The sore rapidly extended, the bones became affected, and a rapid exfoliation commenced, which soon deprived her of all the face except the lower jaw and part of the *ossa malarum*. Five years after her eyes were divested of their coverings, the *pharynx* completely exposed to view, the tongue lay exposed from root to apex surrounded by the foul and vacillating teeth of the lower jaw, and the whole surface had a most unhealthy ulcerated appearance. In the course of the following four years the whole ulcerated surface had healed, and the eyes were covered with a thick skin. She was very weak and for a long period had existed on little else than laudanum, of which she took half an ounce daily. She died shortly after, and on examination it was ascertained that the remaining bone was everywhere perfectly sound. (p. 238.)—J. F. S.]

879. What relates to the causes of *caries* of the skull-bones has been already said on the general subject; it is, however, most frequently consequent on syphilis. The *prognosis* is determined according to the variety of the causes as well as the extent of the *caries*. If it occur on the inner table of the skull, or if the skull be eaten through from without to within, pressure on the brain or ulceration of its membranes, which often extends to the brain itself, is to be feared.

880. The *treatment* of this *caries* is guided by the general rules. Only when both plates of the skull are destroyed, especially if the *caries* have

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(*a*) Edinburgh Medical and Surgical Journal, vol. xxxii, 1829.

been developed on the internal, trepanning is often necessary in order to relieve the collection of *pus* beneath the skull, or even to remove the whole diseased part of the bone. In *caries* of the mastoid process especial care must be taken for the proper escape of the *pus*, so that it should not collect in the drum. If the *dura mater* itself be ulcerated or covered with unhealthy granulations, it must be bound up with slightly stimulating remedies, with decoction of bark and lime water, with digestive ointments and the like, and the vital activity assisted by aromatic applications.

B.—OF CARIES OF THE TEETH.

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881. The teeth belong to the bony system, and therefore analogous diseased appearances are observed in them. *Caries* occurs in all the teeth, though more frequently in the molar than in the incisive teeth. Most commonly it begins in the crown, but not unfrequently also at the root of the tooth.

882. *Caries* is developed at the crown of the tooth, either from *without inwards*, or from *within outwards*. In the former, the enamel of the tooth is observed to lose its natural white colour and polish at one or more parts, either on the sides, or upon the top of the crown; clefts and hollows are seen which have a brown or blackish appearance, and gradually enlarge. The affected tooth gives out a nasty smell, and if the destruction penetrate to the inner substance so that the nerve be exposed to the contact of the

air and food, pain of varying severity and duration occurs, frequently also inflammation of the gums and the like. In the second case, no change is, in the beginning, observable on the crown of the tooth, but pain first occurs, is more or less severe and of indefinite continuance, though always soon returning, as often as it is suddenly excited by cold air, cold drinks, and the like. At last, on examining the tooth, a brownish or blackish spot, more or less deep, is observed in the enamel, which gradually enlarges, becomes darker, and destroys the enamel, when the internal substance of the tooth is found to be decayed, so that the enamel is often merely a thin shell which is easily broken.

When the crown is destroyed by *caries*, it spreads also to the root of the tooth, which is likewise destroyed, and then commonly the gums and alveolar process suffer. The gum surrounding the diseased root, puffs up and inflames, (*Parulis*,) and not unfrequently an abscess is formed. Oftentimes the membrane lining the tooth-socket also inflames, *pus* wells up between the gum and the tooth-fang, frequently very severe pain occurs which spreads over the entire half of the face, and is accompanied with swelling of the cheek.

[Occasionally it happens, that without any *caries* of the tooth, irritation is set up in its socket, and when the jaws are firmly closed the pressure of the tooth into the particular socket causes severe pain. In a very few hours the lining of the socket begins to swell and inflame, lifts the tooth much above its proper level, and consequently renders the closing of the jaws still more painful, and chewing the food almost agonizing. This continues for hours, and sometimes for two or three days, when suppuration commences, the pain and swelling subside, and the tooth again descends to its natural place. This unpleasant process is of very frequent recurrence, gradually separates the gum from the fang till the two are quite apart, and the tooth seems held merely by the vascular and nervous connexion of the ends of its fangs, when its looseness and the constant source of irritation it becomes, leads to the tooth being pulled out. Under these circumstances I have unfortunately had personal experience, that the fang is encrusted with a granular deposit seemingly bony. Leeching the neighbouring gum is all that can be done; but when the process has been once set up, it recurs again and again, till the connexions of the tooth and gum are entirely destroyed, although the tooth itself remains entirely free from caries.—J. F. S.]

883. *Caries* at the root of the tooth is often announced, for a long while, by very equivocal symptoms. Pain occurs in the tooth, but rarely of long continuance, inflammation and swelling of the gums about the diseased tooth, which frequently becomes very severe, abscesses in the gums, outside the mouth, upon the cheek, at the part corresponding to the root of the affected tooth (*Tooth-fistula.*) The crown is, under these circumstances, often still completely healthy, and the *diagnosis* can only be properly determined by particular observation of the symptoms mentioned and by the circumstance of the tooth smarting when touched with a metal probe.

884. Besides these symptoms caused by carious teeth, there occur not unfrequently, *caries* of the alveolar processes, diseased changes of the Highmorean cavern, if the tooth be in the upper jaw (1), as well as swellings and excrescences upon the gums, (*Epulis*,) which are of different kinds, sometimes soft and spongy, sometimes firm and hard, sometimes slightly or not at all, but at others severely painful; sometimes they have a broad, sometimes a pedicled base, and various size, but always red, and they are situated more commonly on the under than on the upper jaw (2).

[(1) Occasionally the inflammation extends from the sockets of the upper molar teeth into the Highmorean cavern, the lining of which becomes inflamed and suppurates.

This is accompanied with much deep-seated aching pain, and dusky redness, with tenderness of the cheek. When these symptoms are present, the condition of the cavern may be suspected; and the mouth must be examined, to ascertain whether there be any stumps of teeth in the neighbourhood exciting the irritation. If there be any such, they should be removed, and a probe, or iron wire, or a small trocar must be thrust up the tooth-socket, to open a way into the cavern, by which the pus may escape. This aperture will require for its establishment, the insertion of a little wooden plug, which should be removed three or four times a day, so that the pus may flow out. It is also a good plan to syringe the cavern with warm water through this hole, especially if the discharge be offensive; and if there be reason to suppose any ulceration of its lining membrane exist, injections of weak solutions of nitric acid may be used with advantage.

(2) "The tumour of the gum, *epulis*, is often," observes LISTON (*a*), "a simple growth of the consistence of the structure from which it proceeds, and not likely to be reproduced, if the exciting cause is removed, and the entire disease extirpated; the cause is decay of some part of one or more teeth, of the crown, neck or fang, or it may arise from their being crowded and displaced. The lower jaw is the most common situation of *epulis;* it appears in the front of the mouth, occasionally at the root of the *molares*, and the upper jaw is by no means exempt from it. Some of the large tumours in my collection, removed along with this bone, appear originally to have commenced in the alveolar ridge. The size and extent of *epulis* is various; it may be confined to the gum betwixt two teeth, or it may have been neglected long, have taken in several, and may be attended with alteration in structure of the alveolar processes and their covering. The disease is generally connected with affections of the permanent teeth, but it is met with as a disease of infancy. * * * * The tumour is of slow growth; it remains generally of the same firm consistence, and its attachments are broad and firm; its surface, even when large, is covered by membrane, is unbroken, it becomes lobulated, unless it projects from the mouth, and is exposed to injury; the teeth are loosened, and present in various parts of the tumour; around their base some excitement may be kept up, and even some ulceration and discharge. The tumour is not of a malignant nature in general, and even in its advanced stages is not inclined to contaminate the parts in its neighbourhood; if thoroughly removed, it does not return. A soft tumour of the gum, rapid in its progress, broken on its surface, and furnishing fetid and bloody discharge, is sometimes, it is said, met with; there is no danger of mistaking the one kind for the other, the remediable for the malignant; fortunately the latter is rare." (pp. 255, 56.)

I have occasionally, though not often, seen *epulis* of both kinds mentioned by LISTON; that which seems merely a luxuriant growth of one particular part of the gum, is most frequent, but that directly connected with the teeth is more rare. Of the latter kind I operated some time since, on a boy of twelve years old; the tumour was about the size of a bean, on the outside of the left branch of the lower jaw, when first observed, but in the course of two years it spread slowly, as far back as the last molar, and forward to the outer incisive tooth; it had risen to the edge of the gum, but had not descended quite so low as the base of the jaw; in front, its lower edge had either absorbed and imbedded itself in the jaw, or bony matter had sprung up around it, as it had there a distinct though irregular edge, but behind the ridge was less marked; its size was that of half a walnut; it was elastic, fluctuating, and seemed enclosed in a tough cyst, thinnest above; the membrane of the mouth moved freely over it. At the operation, the cyst was found to have a cartilaginous feel, and the shell of the jaw-bone evidently involved in it. When opened by a crucial cut, about a drachm of glary fluid was discharged, and at the bottom of the cavity, against the side of the jaw, was the second permanent bicuspid tooth, like the so-called lady (the grinding teeth) in the lobster's stomach. The tooth was drawn, the whole sac removed with scissors close to the surface of the jaw, and the remaining capsule sliced off. The case did well at the time, but eighteen months after he came again with a return of the swelling in the same place, but of a firmer texture. Having lost sight of him since, I do not know what has ensued.—J. F. S.]

885. The causes of *caries* of the teeth are either *external* or *internal*. To the former belong the improper use of acrid acid substances, negligent cleansing of the mouth, alternate use of cold and hot food, tobacco chewing, and mechanical injury of the teeth, by which the enamel is destroyed, and its internal substance is exposed to the air. In most cases, however,

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(*a*) Practical Surgery.

caries of the teeth depends on an internal cause, namely, on that kind of *caries* which is developed in the interior of the tooth. This opinion is especially grounded on the circumstance, that rottenness of the teeth frequently appears in every member of the same family, that the corresponding teeth on both sides are attacked together, and the *caries* is accompanied with general disease, as rickets, scurvy, mercurial cachexy, bad constitution, weak chest, and the like. The spreading of the *caries* to the neighbouring teeth seems rather grounded on the collection of part of the food, which putrefies, or on the general causes, as in a peculiar participation, from the first, of the affected teeth.

Coffinière imagines that in persons with weak chests, the cure of the tooth-ache should not be effected by drawing the tooth, as by retaining the diseased tooth a good derivation may be kept up (*a*).

886. As to the *treatment* of carious teeth nothing can be done to prevent the further spread of the *caries* than removing the causes and improving the constitution, which in many instances is indeed impossible, as often no actual cause can be discovered.

887. For the purpose of restricting the further destruction of carious teeth many remedies have been proposed, which either destroy the carious part, or protect it from the contact of the air or food. To these belong spirituous aromatic tinctures, ætherial oils, kreosote, and even the actual cautery. In superficial *caries*, the carious part may be removed, by filing or scraping, for the purpose of preventing its effect upon the neighbouring teeth. As to the former remedies, they diminish the sensibility by their irritation of the nerve of the tooth, therefore the pain is lessened, and even the offensive smell of the tooth improved, but the progress of the *caries* is not in the least arrested. Filing the carious tooth, only for the time, suspends the evil; usually it soon reappears, and makes quicker progress than before, especially in old persons. Filling up the carious tooth with thin lead, tinfoil, or with tooth-cement, and the like, (stopping,) after the sensibility has been put an end to by acrid remedies, keeps the air and the food from the carious part, but the *caries* is not thereby removed. The cavity of the tooth always increases, and the metal at last falls out.

In order to avoid drawing the teeth, and whilst keeping them in, to get rid of the pain, the destruction of the nerve with hot platina thread or with hot iron, as well as, if the crown be tolerably healthy, the trepanning of the tooth in the direction of its root, by which the nerve is destroyed and then the tooth stopped, as also the introduction of a drop of concentrated sulphuric acid has been employed (Ryan.)

[Chelius's observations as to the falling out of the stopping are very correct, and it is frequently on this account necessary to repeat this operation, however skilfully performed. Before stopping, however, it must be ascertained whether the carious cavity be tender on touching with a probe, for if it be, the pressure of the stopping, whatever it may be, cannot be borne, and often excites such violent pain, that the tooth at once requires removal. I much prefer filling the hollow, once or twice a day, with a bit of cotton steeped in camphorated spirit, as it gradually diminishes the sensibility of the nerve, and sometimes entirely destroys it, so that it either renders the stopping bearable or sometimes even unneeded. All severe escharotics should be avoided, for they often increase the mischief, and compel the removal of the tooth.—J. F. S.]

888. It is most proper to recommend especial care of their teeth to persons affected with carious teeth, consisting in frequently rinsing the mouth, with water not cold, especially after every meal, and in removing with a quill toothpick everything between and in the teeth. For cleaning the teeth, which should be done every morning, a fine powder of linden wood

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(*a*) Ondet, Dictionnaire de Médecine, vol. x. p. 174.

charcoal and bark, with a not too stiff tooth-brush is best; the mouth should also be frequently rinsed with sage water, and some tincture of myrrh or catechu, partly to improve the smell and partly to harden the gums.

889. If the tooth be painful, the *treatment* must be, in reference to the causes which produce the pain. The toothache is often of the rheumatic kind, in which it is not merely confined to the affected tooth, but the pain extends, more or less, over all the teeth of the same row, and over half the face. Warmth is here serviceable, covering the affected side of the face with flannel, a blister behind the ear, and if inflammatory irritation be also present, leeches applied to the affected side. The toothache often arises from bits of food remaining in the hollow of the tooth, which must therefore always be examined and freed from such impurities. If, however, the pain continue, its diminution must be attempted by remedies, which either subdue the excited irritability, as rinsing the mouth with warm water with the addition of tincture of opium, the application of cotton soaked in the same tincture, an opium pill in the hollow tooth, and the like; or, to destroy the sensibility, acrid remedies, the ætherial oils, kreosote on wool in the tooth, have been used, to which also belong most of the empyreumatic remedies recommended against the toothache.

[Tooth-ache commonly so called is much more frequently arising from inflammation of the lining of the socket than from affection of the tooth itself. It is therefore highly necessary to discriminate between the two, as otherwise a good and useful tooth may be drawn which might be saved, simply by repeatedly leeching the gum; and even when the gum is affected secondarily after *caries*, the tooth may even then be often preserved by this practice, and the exposed nerve becoming gradually destroyed, the tooth-ache after a time subsides, and the pain of drawing the tooth is spared.—J. F. S.

Among the various remedies proposed, Bedingfield (*a*) advises, as an improvement on smoking tobacco, often used for the tooth-ache, the application of the fumes of henbane seed, in the following way:—"Put from one to two drachms of the seed upon a red-hot iron, or some lighted cinders, and immediately cover them over with a basin. As soon as you suppose the seed to be consumed and the vessel impregnated with the fumes, place it upon its bottom and fill it with boiling water. The person affected with the tooth-ache is then to inhale the vapour for twenty minutes or half an hour, a blanket or some other covering being previously thrown over the head and shoulders, to prevent its escape." (p. 492.)]

890. If the pain cannot be in any way removed, or if the diseased tooth produce any ailment of the jaws, lips, or maxillary cavities, and so on, it must be drawn. This is also necessary if a tooth of the first set prevent the development of the second.

If with carious crown the root be sound, the crown may be removed with a pair of sharp nippers or with a fine saw, and the exposed medullary cavity cauterized, which however, is usually only employed in the introduction of a tooth.

891. The proceeding in drawing a tooth varies according as the *forceps*, the *key*, the *pelican*, the *punch*, or the *pyramidal lever* be employed. The preference of one or other depends on the condition of the tooth to be drawn, and the individual dexterity of the operator with one or other instrument. In general, the drawing of a tooth with forceps, is the least painful; it is, however, only applicable to the front, or to loose back teeth. The key is best, for drawing the hind teeth, as it permits the use of greater force, without injury to the other teeth, and has not any rest upon the neighbouring teeth; the gums are, however, thereby frequently crushed, and the tooth not rarely broken. The pelican acts more safely; it is

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(*a*) Edinburgh Medical and Surgical Journal, vol. xii. 1816.

applicable to all the hind teeth and their stumps, the gums are not crushed, and the tooth not easily broken; but the neighbouring teeth must afford it support and are liable to be thereby depressed; the tooth can also be drawn with it only outwards. The punch and the pyramidal lever are only in the removal of stumps.

892. In drawing the *front teeth* of the *lower jaw*, the operator must place himself before the patient, who sits upon a sloping chair; he depresses the lip with the fore-finger of the left hand, puts the thumb on the next tooth, and the other fingers beneath the jaw, and with the *curved forceps* seizes the neck of the tooth as low as possible, makes a little movement inwards and outwards, and then gives the forceps a pull upwards, by which the tooth is drawn. In drawing the *front teeth* of the *upper jaw*, the operator stands behind the patient, who sits on a low stool, separates the lip with the thumb of the left hand, seizes the tooth with the *straight forceps*, moves it a little in and out, and draws it with a pull directly downwards.

893. The *hind teeth* are drawn, either with the *key* or with the *pelican*. In the former case, the operator envelops the bolster of the key with soft linen, after he has fitted it with a claw, of corresponding size to the diameter of the tooth, and places himself before the patient sitting on a common chair. He then fixes the claw of the key with the right hand, if the diseased tooth be in the left side of the jaw, but on the opposite side with the left hand, extends the forefinger on the stem of the key, fixes the point of the claw, by means of the guiding forefinger of the unoccupied hand, as deeply as possible, on the inside of the tooth, and keeps it fixed with that finger. He then turns the handle in a half circle downwards on the teeth of the lower, and upwards on the teeth of the upper jaw, by which the tooth is either at once drawn, or remains still connected with the gum, from which it may be completely separated with the fingers or forceps. If on account of the inner side of the tooth being destroyed, it must be drawn inwards, the point of the claw should be fixed externally, and the turn made with the handle of the key inwards.

In using the *pelican*, after having chosen a claw proportionate with the thickness of the tooth, and the distance of the point of support from the diseased tooth, and having covered the crown of the instrument with soft linen, the operator places himself behind the patient sitting on a low stool, fixes the pelican with the right hand in drawing a right side tooth, and the contrary, with the left hand, puts the point of the claw as deeply as possible, on the inside of the tooth, fixes the crown against the two neighbouring teeth in front, and the thumb of the unoccupied hand against the inside, and with the other fingers of the same hand grasps the jaw outwardly and beneath. The handle of the pelican is then moved from behind, forwards and laterally, by which its crown is pressed against the teeth, serving as the pressure point, and the tooth is somewhat raised. If there be no adjoining teeth to support the pelican, a piece of cork must serve the purpose.

894. In the use of the *punch*, which is advisable only in teeth not very firmly fixed, the operator stands in front of the patient sitting on the sloping chair, if the teeth be of the lower jaw, but behind the patient, who is to sit low, if the teeth are of the upper jaw; he fixes the claw of the instrument against the root of the tooth, and the forefinger of the left hand

against its inside, and then lifts the tooth inwards and upwards in the lower, and the contrary in the upper jaw.

895. The *stumps* and *roots* of teeth may be removed by one or other of these means. If they be loose, they are especially fitted for the forceps, or punch; those which are firmly fixed for the key, or if there be still neighbouring teeth left, for the pelican. Only when by these methods the stump cannot be removed, must the *lever* be used. The head of the patient is to be supported, the point of the lever fixed sufficiently deep, between the edge of the alveolar process and the root of the tooth, a lever-like motion is to be made to either side, where there is least opposition, and the root lifted out. In very firmly fixed roots, two levers may be applied in the same way, on the two sides.

896. The awkward circumstances which may occur from drawing teeth are, breaking off the crown of the tooth, breaking the alveolar processes, bruising, tearing, or complete stripping off the gums, loosening the neighbouring sound teeth, partial dislocation of the teeth, fracture of the jaw, slipping of the claw from the diseased to a sound tooth and its extraction, severe bleeding, inflammation and suppuration of the gums, and *caries* of the alveolar processes.

If the crown of the tooth break off, the removal of its stump is to be attempted as already mentioned. In splintering the alveolar process, the loose pieces must be removed, and those which are fixed pressed into place. Bruising of the gums must be treated with slightly astringent gargles. If part of the gum remain only slightly connected, it must be cut off with scissors. Teeth which have become loose must be fastened to those adjoining with threads, and hard food should be avoided. If a tooth be partially dislocated, the pain is often thereby completely got rid of, and it remains firm in the socket, although *caries* go on; but the dislocated tooth may operate in its socket as a foreign body and cause pain, the gum and the lining of the socket may become affected, and thereby the removal of the tooth be rendered necessary. Fracture of the lower jaw requires its proper treatment. A sound tooth which has been pulled out may be put in again, and fixed by threads to its neighbours.

A slight bleeding occurs after the drawing of every tooth; this is to be permitted for a little while, because thereby is the inflammation of the gum best prevented; washing of the mouth with water and vinegar, and compression of the tooth-socket are usually sufficient to stop it. Frequently the bleeding is very severe, because perhaps the artery going to the tooth is torn, where it is in the bone and cannot retract, or on account of scorbutic *diathesis*. In this case firm compression must be employed, the socket filled with lint soaked in a solution of alum, in Theden's arquebusade, and the like, or with oak agaric strewed with styptic powder, or with a ball of wax; small compresses are to be put upon these, and the patient made to bite the jaws firmly together. In doubtful cases, the application of the actual cautery has been recommended. In the scorbutic *diathesis* the simultaneous internal use of acids is not to be neglected (1).

The inflammatory swelling of the gums requires a soothing treatment, bathing with warm milk, figs boiled in milk, and so on. In general it runs on readily to suppuration, and if the abscess do not soon burst of itself, it must be opened with a lancet. The aperture usually closes under the continued use of soothing gargles. *Parulis* requires the same treatment if caused by a decayed tooth, and if that be the reason of the aperture not closing, the tooth must be drawn. If there be *caries* of the alveolar process, it must be treated according to the general rules.

[(1) The bleeding which ensues occasionally in consequence of drawing a tooth of a person who has hæmorrhagic *diathesis*, is a matter of very serious consequence, and has sometimes destroyed life. I have seen several severe, though not fatal cases, of this kind, and as it seemed to me, that the blood came from the very bottom of one or other of the fang-sockets, when the tooth had more than one, I presume that the bleeding vessel was the proper artery of the tooth, and that the difficulty in arresting the hæmorrhage depended on the difficulty of getting at the vessel itself; for unless it can be immediately acted upon, whatever be the local application, it is sure to fail. Various remedies have been proposed; I have tried most of them without success, but I have never failed with the actual cautery, when I have properly applied it, that is, when its point has been sufficiently small to descend into the very bottom of the fang-socket. When I first had recourse to this practice I failed from not thrusting the hot wire (which makes the best cautery for this purpose, and should not be more than a line thick) down to the very bottom of the socket; but having corrected this error, I have never failed since, in at least half-a-dozen cases; and, therefore, believe that its inefficiency in the hands of others has arisen from the same cause which at first foiled me. There is nothing very frightful in the employment of this remedy, nor does it produce more than momentary and slight pain, and I think it is, therefore, best to resort to it at once without wasting time, and allowing the patient to lose blood to such extent as to disturb the constitutional powers, and excite any latent phthisical tendency, of which I have known an instance.

Blagden mentions (*a*) the case of a person, who, whilst a boy, after the extraction of a tooth, bled from the socket for twenty-one days. Whenever he cut himself, or received a slight wound, there was always great difficulty in stopping the bleeding. At twenty-six years of age he had a trifling wound on the forehead, which bled profusely, and could not be stopped by pressure or styptics, or even by tying both ends of the artery, but was finally checked with caustic potash, which caused a large slough. In the next year he was much troubled with *caries* of the second upper molar tooth, which, remembering what had previously happened, he bore with for some time, but at last the pain became so severe that he had the tooth drawn *June* 30, 1816, and at its bottom was an abscess; free bleeding immediately ensued, and this continuing on the next evening, Blagden being called to him, applied lunar caustic to the bottom of the socket without effect; then introduced a sponge tent soaked in solution of sulphate of copper, which checked the bleeding for a few hours, but it recurred, and continued profuse, notwithstanding that the socket was carefully plugged. On the morning of *July 4th*, Brodie applied the actual cautery, and stopped the bleeding for six hours, but in the evening it broke out afresh, as violent as before, notwithstanding the socket was again carefully plugged, and the cautery twice applied; in doing the latter, a large quantity of matter apparently from the maxillary sinus, escaped. The bleeding still continued, and next day the patient being very low and depressed, although he had never fainted, it was determined to tie the common carotid artery, which was done by Brodie at 10 A.M., but " the hæmorrhage still continued. The wound made in the operation bled very little at first, but in the course of a few minutes after the operation it began to bleed profusely. No single vessel could be observed bleeding, but there was a general oozing from its surface. Ice was applied to the wound, and while this was continued the bleeding from it was suppressed, but it returned immediately on the ice being removed. Ice was also applied to the left side of the face, and there was reason to believe that it stopped the bleeding for a few hours; however, the hæmorrhage afterwards returned, and the patient died at 5 A.M. on the *7th July*, a week from the time of the removal of the tooth." (p. 224-27.)

The following case was under my own care:—

C. K., aged 20 years, a leather-dyer, of delicate frame and not very temperate habits, was admitted into George's Ward

June 17, 1837. Twelve years since had leeches on his left arm, which bled for several days. Three years ago had leeches on his hip, which continued bleeding for three or four days. Eighteen months since had the first right upper bicuspid tooth drawn, which did not cease to bleed for four days. On the 12*th* of this present month, at 8 P.M., he had the second left upper molar tooth pulled out, which was immediately followed, by considerable bleeding, and which continued during that night and the following day and night, he only attempting to stop it by frequently washing his mouth with cold water. On the morning of the 14*th* he went to his medical attendant, who applied

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(*a*) Medical and Chirurgical Transactions, vol. viii. 1817.

nitrate of silver to the fang-socket; the bleeding ceased for a couple of hours, but recurring, he introduced some nitric acid, which, however, only checked it for a short time, and the patient was content with washing his mouth with cold water till 1 P.M. of yesterday afternoon, when he came to the hospital, and the dresser plugged the socket with sponge dipped in tincture of myrrh and alum; after which the bleeding ceased for eight hours, but then came on again. and continued through the night till 11 *o'clock* this morning, when he came again to the hospital, and the dresser applied a hot wire to the socket, which checked but did not stop the bleeding entirely. It soon, however, burst out afresh, and at 7 P.M. he returned to the hospital, and having been admitted, the dresser applied muriatic acid, but without effect. I saw him soon after, and having cleared away the clot, found two bleeding points, one by the alveolar partition of the third molar tooth, and the other deeper in the socket. To these I applied the actual cautery at a black heat, and the bleeding ceased, but soon recurred; and when I saw him again four hours after, I found a clot about the socket as big as a nut, with a free arterial stream flowing from beneath it; this I removed, plugged the socket with cotton steeped in *tinct. benz. comp.*, and directed pressure should be kept up so long as there was any bleeding. After four hours it seemed to have stopped, but in half an hour burst out again, and continued through the night. At 8 A.M. *June* 18, a pencil of lunar caustic was introduced, and the surface of the socket being freely cauterized, the bleeding was checked for a short time, but the oozing soon recurred, and when I saw him three hours after, a fresh clot had formed and the bleeding continued as before. I tried to make pressure upon a pad of cotton thrust into the socket, with a bell-spring carried over the crown of the head, but could not effect it. I then made a paste of tannin and cotton mixed with spirits of wine, thrust it into the socket with a probe, and pressed it down with the finger till it had become converted into a concrete, by which the bleeding was completely stopped, and so continued for six hours, when it broke out afresh and continued streaming till 8 P.M., at which time I saw him again, found the plug thrust out completely and the socket filled with clot. This I removed entirely, and after squeezing for a few minutes the soft parts about the socket, which were swollen, with my finger and the lint, which gave him great pain, but stopped the bleeding, I left the socket alone, and applied linen dipped in spirits of wine as an evaporating lotion on the cheek. His bowels not having been relieved for the last two or three days, three grains of calomel, with some infusion of senna and sulphate of magnesia, was ordered forthwith. No bleeding for five hours, after which it came on again, but pressure being made for a little time, it ceased for an hour, and then returning, continued through the night till I saw him at 11 A.M of the 19*th June*, when I removed a clot as big as a walnut, and plugged the socket with cotton steeped in kreosote, and ordered one grain of acetate of lead three times a day. There was no bleeding for twelve hours, but it then returned and continued through the night till next morning, when I saw him, and having cleared out all the clot and made a little pressure, it ceased. As he complained of pain in his belly, the lead was omitted after he had taken four doses. In the evening the bleeding returned, but was stopped during the whole night by plugging with cotton and kreosote. On the morning of the 21*st June* the bleeding returned, a fresh clot formed and the oozing from beneath it as before. On the 18*th* he had not appeared to have suffered much, his countenance was not particulary pallid, and his pulse, though rather quickened, was firm and free from hæmorrhagic jerk; but now he is pallid, complains of faintness, the pulse is quick and has the jerk which has not been previously noticed. On consultation with my colleague GREEN, it was determined to apply the actual cautery again; and having made a careful examination, I was only able to discover one fang-socket, through which however the probe readily passed into the maxillary cavern. I then passed a conical iron at a black heat to the very bottom of the socket, which caused great pain, as I expected, from the already irritable and inflamed state of the parts after so much handling; and I also seared the sides of the cavity and the gum, from which there was some oozing. The bleeding then ceased. He was ordered to take every eight hours two grains of acetate of lead, with half a grain of opium. There was no recurrence of the bleeding after this; the lead was continued for two days and then left off, and in the course of a week he was quite well and left the house.

On the 4*th March*, 1841, he had the second left lower molar tooth drawn at the hospital, from which, excepting a very few hours, bleeding continued till his readmission,

March 8th. The socket was then filled with putty by the Surgeon in attendance, and over it a pad of lint, by which it was stopped for about twelve hours, when it burst forth again, and continued through the night. On the following morning two irons of different size were introduced into the cavity at a red heat, but the bleeding was not checked till the socket had been plugged with lint steeped in tincture of myrrh. After twelve hours the bleeding returned, continued through the night, and till the afternoon of the 10*th March*, when a small iron at black heat was introduced, and lint soaked in solution of alum applied to the part; after sixteen hours the bleeding returned, and on the morning of the 11*th* he had a little bleeding from the left nostril. The solution of alum was continued, and now was ordered *pulv. gallarum, alum. sulph.* āā gr.v. 4*tis.*, but without benefit, and at 3 A.M. *March* 12*th*, a small iron at black heat, was introduced; but the bleeding did not cease till the socket was plugged with lint soaked in alum. At 9 A.M. the bleeding returned; a bladder of ice was then applied to the throat and cheek, and he was ordered *plumb. acet.* gr.j. *op.* gr.¼ *secundâ quâque horâ per sex vices, tunc tertiâ vel quartâ quâque horâ per sex vices sequentes, et postea sextâ quâque horâ.* There was not any recurrence of the bleeding till the evening of the 14*th March*, when he again bled freely, and the lead and opium were again ordered every two hours, but on the following day, only every four hours. *March* 16*th*, he was directed to take a grain of muriate of morphia, which was continued for a few days. On the 18*th* the bleeding was again free, but finally stopped on the 21*st*; and he left the house well on the 29*th*.

How long the lead was continued in the second part of this case, the notes I have quoted, which were not my own, do not distinctly state, and I think it doubtful whether the cure was to be ascribed to it or simply to the loss of blood, by which in a case related by Davenport (*a*), the bleeding had certainly been put a stop to after thirty hours' continuance, and depressing the patient very considerably. I cannot help, however, thinking that in the second part of this case the actual cautery was never effectually applied; for as I have said before, Ihave never failed when using it, neither has my colleague Green, who also employs it.

From the above cases it will be perceived how various have been the remedies made use of to stop these violent bleedings after drawing a tooth, but many other plans have been advised and strongly urged as most efficient. Some persons reinsert the extracted tooth in the socket as the best plug which can be used. Cortez (*b*) recommends the introduction of a wax model into the socket, which he has found effectual in three or four instances. Peter Cullen (*c*) prefers a very fine soft phial-cork gently squeezed into the socket, and upon the point of the cork, a bit of lint with some styptic may be put. Kendrick (*d*) advises a pledget of cotton dipped in the strongest alcohol as very efficacious. And among the cases of hæmorrhage effectually treated with the internal use of ergot of rye, one of bleeding after drawing a molar tooth is given by Dr. Ryan (*e*).

An interesting circumstance in reference to these cases is, that not unfrequently other individuals of the family to which the patient belongs, are subject to this bleeding disposition. It was so in my own patient's family, and with that of Kennedy's patient, and I have known it in many other instances.

It is scarcely needful to observe, that if the practitioner be aware of the patient or his family being subject to this disposition to bleed, he should be extremely cautious in undertaking the removal of a tooth, or indeed of any operation; and if compelled to resort to it, should at once be prepared to attempt arresting its bleeding at the onset, and not permit its continuance for hours, much less for days, before employing any efficient remedy.—J. F. S.]

897. Tooth-fistulas (*par.* 883) require the speedy drawing of the decayed tooth, and the use of astringent gargles. If the fistula do not then close, it is probable that there is still another decayed tooth, which must be drawn; or *caries* of the alveolar process may exist, which must be treated in the usual way.

Carcinomatous excrescences on the gums (*par.* 884) are mostly consequences of a decayed tooth or of a carious part of the alveolar process. They must be removed from their base with the knife, and the great bleeding which generally ensues must be stopped with astringent remedies and pressure, or with the actual cautery, which last is also serviceable in preventing the recurrence of the excrescence. If after the removal of *epulis* a decayed tooth or *caries* of the alveolar edge be discovered, the former must be drawn, and the latter treated according to the general rule.

Cancerous sores and schirrus will be considered with degeneration of the organic tissues.

(*a*) Medical Gazette, vol. ii. 1842. New Series, p. 58.

(*b*) Ibid., vol. iv. p. 490. 1829.

(*c*) Medical Gazette, vol. v. p. 564. 1830.

(*d*) Ibid., p. 788.

(*e*) Ibid., vol. xiii. p. 368. 1833.

II.—OF FISTULAS.

(*Fistulæ*, Lat.; *Fisteln*, Germ.; *Fistules*, Fr.)

898. Unnatural, old apertures, by which fluids are emptied from any cavity or duct externally, or into another cavity, are called *Fistulas*. By this definition fistulas are distinguished from fistulous sores.

["The term 'fistula' gives a very inadequate notion of the disease," observes JOHN HUNTER, "the fistulous canal being only the sign of the disease,—the means of conveying a fluid or extraneous matter to the surface. A fistula is the consequence of the powers of a part not being able to remove the original cause, so that the original cause and some of its effects remain." (p. 577.)]

899. The causes of fistulas, are either injuries, by external violence, of the cavities in which the fluids are collected, or of the ducts by which they are discharged, if they be not cured by quick union, or stopping up of the ducts, by which the fluids collected in large quantities produce tearing, inflammation, suppuration, and mortification, causing extravasation of the fluid, and the cellular tissue, and an unnatural opening for its escape; or inflammation and ulceration on or in the walls of the cavities and ducts, by which the latter are destroyed. Fistulas, if not consequent on injury, usually commence with abscess, which, on bursting, discharges pus of different kinds, by one or several apertures, communicating either directly with the cavities, or running in various turns and windings. If the fistulous passage be very short, it diminishes in size, as the inflammation lessens, the external opening contracts, and its edges scar, but without closing. If the fistulous canal be longer, the external opening contracts, is surrounded by a little fungous wall, which presents in its middle a narrow and often scarcely observable opening. By the continuance of the inflammation, to a certain degree, in the whole canal, and in the neighbouring parts, the whole internal lining of the canal is gradually converted into a mucous tissue, distinguished only from true mucous membrane, by the absence of mucous glands, and of the epidermoidal covering, and itself prevents the healing of the canal. But, for the most part, in long continued fistulas, the neighbouring parts become hardened, and form, more or less, grayish white, thick hard masses, (*callosities*,) between which the fistulas run. The same changes also occur in fistulous passages (*par.* 65.)

["The causes of fistula," says HUNTER, "are various, but may be divided into two classes:—*first*, the obstruction of the passage of some natural secretion, as fistula of the parotid gland; or of the canal for the passage of extraneous matter, as the intestines being strangulated, so as to mortify, or being wounded; but all obliterations of the ducts, where the fluids make a new passage, will not be termed *fistulæ*; *secondly*, the formation of pus or extraneous matter in a part requiring a passage, as in *fistula in ano*, fistula in the joints, and fistula from diseased bone." [It will be observed that this second class of fistulas has not been enumerated by CHELIUS, although, however, he subsequently treats of them.—J. F. S.] "We shall consider the causes of fistulas,—1*st*, The obliteration of ducts, or canals, is the first cause. This arises from obstruction of the natural passages, in consequence of which a new one is formed for the passage of the natural secretion. These obliterations often arise from a thickening of the sides of the ducts, as in the *urethra*, nasal duct, &c., from inflammation; sometimes from the venereal disease, or *scrofula*; and sometimes from accident, as in the parotid duct. These obliterations are often very troublesome, obstructing the evacuation of the natural secretions, which is very teasing to the part, and when complete is very serious in its consequences. In most there is a new passage when complete, which is made by inflammation and ulceration; these new passages are called fistulous; the discharge is the natural secretion, mixed with the pus from the inflamed vessels of the sides of the passage. If this new passage answers all the purposes of the original one, it cannot well be called fistulous; when from a mortified or wounded intestine, it is called an artificial *anus*; when in the *perinæum*, it is for the passage of the urine. There are often accumulations of secreted juices besides the above, arising from the same causes and producing the same consequences, yet not called fistulous." (pp. 577, 78.) *2nd.* The second species of fistula or that from disease, arises from the disproportion in the disposition to heal of different parts, viz., the internal and the external; the skin healing, while the deep seated parts or seat of the disease, have no disposition for it. It may arise from two causes: *1st*, from any extraneous substance in the inner parts; *2ndly*, from a diseased state of the original part when the disease formed. The first happens in large deep-seated abscesses, which are prevented healing at the bottom by the pressure of the matter. The second has two causes; the first, from the part being naturally indolent, as tendons; the second, from a disease in parts naturally ready to heal, but the disease being deep seated, the skin is more ready to heal than the bottom of the *fistula*, and thus obstructs the necessary free discharge." (p. 579.)]

900. The *prognosis* in fistula depends on the possibility of conducting the fluid through the natural ducts; farther, on the condition of the fistulous openings, whether they be accompanied with or without loss of substance, whether they communicate immediately, or by a more or less long canal with the cavity, or with the duct, and whether their walls be converted into a mucous tissue, or callosities. In fistulas of long standing that part of the duct in front of the fistulous opening, and through which fluid no longer escapes, loses its natural area, shrivels up, and the cure is only possible by making an artificial aperture in the cavity, into which the fluid should be conveyed by the natural duct, as for instance, in Salivary Fistula.

901. The indications for the cure of fistulas are, therefore,—1. The *restoration of the natural ducts and the conduct of the fluids from the fistulas*. This is usually sufficient, and the fistula closes of itself, if the mucous lining, or the callosities, have not formed. In this case the canal of the fistula must be either divided, or a sufficient degree of inflammation and adhesion produced by stimulating remedies and suitable compression. The callosities usually subside, if the flow through the fistula be prevented by the use of soothing applications. 2. The *establishment of an artificial duct*, if the restoration of the natural passage be not possible, which effected, the fistula closes, either of itself or under the abovementioned treatment. If the fistula be an immediate opening to a duct, without narrowing of the latter, cauterization about the fistulous opening is the best remedy to produce gradual lessening and ultimate closing of the fistula. The paring the edges of the fistula, and their union, has rarely had satisfactory results. This treatment by cauterization (with caustic remedies, or with the actual cautery) is founded on the central contraction occurring in burns (*a*). If with such fistula there be considerable loss of substance, the opening can often be only closed by implanting or drawing forward skin from the neighbourhood.

["The cure of *fistulæ*," observes John Hunter, "consists in first removing the immediate cause; for frequently they get well by simply removing the obstruction. * * * The cause of our first division of *fistulæ*, arising from confined matter, is sometimes easily removed, but not always, by opening the suppurated part in the most depending situation, when, if the parts are readily disposed to heal, a cure takes place. The second, from a diseased state, must have the disease removed or extirpated if possible; but this is often impracticable. A perfect exposure is the next object; but the case will not often admit of it, and then becoming incurable, it sometimes produces hectic, as in lumbar abscesses and abscesses of the liver which open externally, but cannot be exposed. The constitution in such cases is to be most attended to, and every thing done to lessen the irritation; but in most cases life is miserable, and we only protract it a little longer by our best efforts." (p. 581.)]

(*a*) Roser, Ueber eine besondere Art von Fisteln, welche durch Cauterisation im Umfange der Fistelöffnung zu heilen sind; in Archiv. für Physiologische Medicin, von Roser und Wanderlich, 1842, pt. i. p. 145.

A.—OF SALIVARY FISTULA.

(*Fistula Salivalis*, Lat.; *Speichelfisteln*, Germ.; *Fistule Salivaire*, Fr.)

Duphénix, Morand, Louis, Observations sur les Fistules du Canal Salivaire de **Sténon**; in Mém. de l'Acad. de Chir., vol. iii. p. 431.

Desault, Œuvres Chirurgicales, vol. ii. p. 216.

Viborg, Vorschlag zu einer verbesserten Behandlung der Speichelfistel; in Sammlung von Abhandlungen für Thierarzte, Copenhagen, 1797, vol. ii. p. 33.

Jobert, Observations des Fistules Salivaires, suivies de quelques réflexions sur ces Maladies; in Arch. Génér. de Médecine, 1838, Sept., p. 58.

902. *Salivary Fistula* is characterized by an opening surrounded with callous edges most commonly very narrow, in the neighbourhood of **Steno**'s duct, or of the salivary glands, out of which the spittle flows, especially during talking and chewing. The flow of spittle is often so great, that loss of appetite, disturbed digestion, and wasting result from it.

903. Salivary fistula is produced either by accidental injury of the salivary glands, or their ducts, if the first union do not take place; or by ulceration of this tissue, or by the salivary duct being stopped up by means of stony concretions; and in the latter case, a fluctuating swelling arises in the course of the duct, which gradually enlarges, bursts, and discharges the spittle.

904. The *treatment* of salivary fistula varies according as it is situated on the duct itself, or on one of the small ducts from the gland.

905. The salivary fistula, which can be distinguished, partly by its seat, and partly by a probe introduced from the mouth into **Steno**'s duct, is usually cured by continued pressure, which diminishes the secretive activity of the gland. A compress an inch and a half thick is to be put on it, and fastened with the halter bandage. At every renewal of the bandage, camphorated oil is to be rubbed upon the region of the gland, and the fistulous opening touched with lunar caustic. The mere repeated application of caustic, especially of nitrate of silver, is commonly sufficient for the cure.

906. The treatment of fistula of the Stenonian duct, consists either in the *restoration of the natural passage for the spittle, or in the formation of an artificial passage by which the spittle may flow into the mouth.*

907. The restoration of the natural salivary duct, is only possible when its division has not been of long standing, and the lower end is still pervious, which may be ascertained, with a fine probe, from the mouth, or by injection into the fistulous opening. The modes of treatment proposed for this purpose are,—1. The union of the edges of a recent division by the twisted suture, in which one, two, or three stitches, according to the size of the division, are put in. 2. The introduction of a silken thread, by means of a delicate eyed probe, through the lower end of the duct into the fistula, and its removal when the duct is thought to be sufficiently widened; after which the fistula closes, either of itself, or by the application of caustic (*a*). 3. Compression of the duct from the fistula up to the gland, in consequence of which œdematous swelling of the gland and the neighbouring parts ensues, which soon destroys the use of the divided parts (*b*). 4. The efficient touching of the fistulous opening with nitrate of silver, or the application of a paste of sublimate and bread crumbs

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(*a*) **Louis** and **Morand**, above cited.

(*b*) **Masseneuve**; in Mémoires de l'Acad. de Chirurg., vol. iii. p. 452.

moistened with decoction of marshmallows, which should be covered with a compress dipped in spirits of wine, and supported with a suitable compress, for the purpose of preventing the escape of the spittle by the slough produced, and also to induce its flow into the lower end of the duct. By this plan, as well as by compression of the duct, in most cases its closure and destruction is effected, which **Desault** and **Richter** aim at in reference to the salivary gland, by endeavouring to destroy its function with continued pressure.

Schreger (*a*) also notices a fistula which closed by compression of the duct behind it, with a steel neck circlet descending from the top of the head, and by touching it with lunar caustic. Here also belongs **Viborg**'s proposition in cases of salivary fistula, where the usual modes of treatment have been inefficient, to lay bare the hinder end of the duct, by a cut directly down from the cheek-bone, and to bind and unite the wound with sticking plaster. In this way, from **Viborg**'s experiments on brutes, it results, that after tying the Stenonian duct, the parotid gland swells, gradually subsides, and the destruction of the gland is effected.

908. The production of an artificial duct is the usual mode of treating a salivary fistula, and is always indicated, if the division of the duct have been of long standing, the fistulous opening callous, and the lower end of the duct have become impervious. It is effected in different ways:

1. The callous edges of the fistula having been pared with the knife, a tube with a small trocar is thrust through the cheek, near the hinder opening of the salivary duct, somewhat downwards, and in an oblique direction, in doing which the tongue is to be defended from injury by the finger introduced into the mouth, or by a piece of cork. The trocar is now withdrawn and a thread of silk-worm gut introduced through the tube, which is also then to be removed. The patient should now chew, for the purpose of discovering the aperture of the salivary duct by the flow of the spittle, and the gut in the wound is then to be thrust into this opening for about six lines; the patient then chews again to see whether the spittle flows out between the gut and the wall of the duct, on failure of which, a thinner gut must be introduced. The end of the gut hanging in the mouth is to be brought out to its corner, and fastened with sticking plaster on the cheek. The edges of the wound are to be brought, by properly applied sticking plaster, into the closest union, covered with lint, which should be fastened with sticking plaster, and a cloth placed beneath the chin and bound together on the head. The bandage must not be renewed till the edges of the wound have united, which happens in from thirty to forty hours, if the operation succeed; and some hours after, the gut also may be removed.

De Roy was, according to **Boyer** (*b*), the first who employed an artificial opening by means of perforating the cheek, for which purpose he used the actual cautery which he thrust directly from without inwards.

Percy (*c*), after penetrating the cheek, introduced a leaden thread into the upper end of the Stenonian duct, and the other end of the thread through the artificial opening in the mouth, where he bent it round, and fixed it by slight pressure of the cheek against the teeth. This treatment renders the suture and cauterization unnecessary.

2. The cheek being penetrated, as in the former case, a leaden thread or string is introduced through the tube, the two ends of the thread bent round like a hook after the removal of the tube, and left for four or six weeks; the external fistulous opening, after having been pared, is to be

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(*a*) Grundriss der chirurgischen Operationen vol. i. p. 84. Third Edit.

(*b*) Traité des Maladies Chirurgicales, vol. xxvii. p. 276.

(*c*) **Boyer**, above cited, p. 280.

closed with sticking plaster For the purpose of rendering the opening callous, after perforating the cheek, the introduction of a sufficiently thick thread, first smeared with digestive salve, and subsequently with drying remedies, and to be moved daily till suppuration have ceased, has been recommended; in that case, the closing of the external fistulous opening first takes place, which, if small, may be effected by frequent touching with lunar caustic; or, if larger and very callous, by paring with the knife, and drawing together with sticking plaster. The aperture is also sometimes attempted to be kept open, by the introduction of a golden or leaden tube, over which the external wound heals.

Duphœnix penetrates the cheek with the bistoury, and puts a canula into the inner half of the wound, for the purpose of preventing its union, and at the same time to conduct the spittle into the mouth, till the external wound, the edges of which are brought together with sutures, has healed.

Atti (*a*) introduces, into the opening made with the trocar, a leaden canula, the end of which in the mouth he splits into three, and bends back on the membrane lining the cheek; the outer end must not reach the skin, and is kept in its place by a thread carried round the ear. After a sufficient time the thread should be divided, the canula removed from the mouth by the nail of the forefinger, and the internal opening remains permanent.

3. The membrane of the cheek is to be penetrated twice, obliquely at the bottom of the fistula, with a trocar, and through these openings a leaden thread is introduced, the middle of which should lie in the bottom of the wound, and the ends projecting within the mouth, are to be brought together and cut off near the inside of the cheek. The external wound is to be closed by the twisted suture. The spittle flows along the leaden thread into the mouth, the external wound closes, and the thread drops into the mouth. This treatment is preferable to the others, as no repeated bandaging of the wound is necessary. I have proved this plan in several cases where other modes of treatment have been employed without benefit (*b*).

Croserio (*c*) proposes, instead of perforating the cheek from without to within, according to the plan of Deguise and Beclard, to thrust the trocar from within outwards, also to make the second perforation with a trocar from without inwards, the canula of which has no shoulder, and therefore after the introduction of the leaden thread may be withdrawn through the mouth.

4. In simple fistula, the membrane of the cheek should be pierced with the bistoury, and the external edges of the fistula brought together. But complicated fistulas must be cut out, and the outer edges of the wound brought together (*d*).

Bonafont (*e*) exposes the Stenonian duct to the extent of a centimètre, isolates the corresponding ends of the fistula for some millimètres, perforates the cheek with a trocar, draws the end of the Stenonian duct, with a thread into the canula, which is left behind, and fastens the thread in a cleft of the canula. The union of the external wound is effected by suture.

[The fistulous orifice into the parotid duct, resulting either from abscess of the gland or any other cause, is not so easy of union as Chelius would wish to infer, but on the contrary often very tiresome to treat. Desault punctured the cheek with a trocar and canula, through the fistulous opening, and introduced a seton into the mouth. The seton was removed daily, and gradually increased in size till a permanent passage into

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(*a*) Begin; in Dict. de Médec. et Chirurg. Prat., vol. xviii. p. 225.

(*b*) Deguise; in Journal de Médecine, etc., par Corvisart, etc., vol. xxi.

Beclard; in Archives Générales de Médecine, Octobre, 1824, p. 285; in Richerand, Histoire des Progrès récens de la Chirurgie, p. [illegible]8.

Vernes; in Journal Général de Médecine, Nov. 1828, p. 270.—Does he use a golden thread in the same treatment?

(*c*) Archives Générales de Médecine, Mai, 1825, p. 137.

(*d*) Jobert, above cited.

(*e*) Annales de Chirurgie, Août, 1841.

the mouth was formed, and then the seton having been removed, the external wound which had been left open, was touched with caustic and healed. **Beclard** in two cases successfully employed a leaden style, one end of which he passed into the mouth and the other into the interrupted duct, and completed the operation by bringing together the edges of the external fistulous orifice, which had been previously pared, with a twisted suture. A much more simple and equally effectual plan is to pass, through the fistula in the cheek, into the mouth a needle and thread, the latter of which is to have a knot made on its end, only of sufficient size to be received when drawn from the mouth into the bottom of the fistulous aperture. The end in the mouth is to be tied on a little bit of stick close to the inside of the cheek. In the course of two or three days the knot ulcerates into the mouth and a new way is formed, by which the secretion of the gland passes, and if the case turn out well, the fistulous orifice soon contracts and heals, care being taken by a compress to prevent the saliva finding its way out externally. Sometimes, however, it is very difficult to induce the external wound to unite, and the production of a new surface, either by paring the edges or touching with caustic, and keeping them in apposition is necessary.—J. F. S.]

909. It is always necessary that the patient, when the external fistulous orifice is to be closed, should keep the lower jaw as quiet as possible till the cure is completed; and only take fluid food through a tube. A carious tooth is often the cause of failure of the operation for salivary fistula, and must therefore be removed before the operation is repeated.

910. The swelling up of the Stenonian duct into a fluctuating tumour, which must be distinguished from an encysted tumour, may, if the duct only be stopped up, be perhaps removed by the introduction of a fine probe. If this be not possible, the swelling should be opened with a lancet from the mouth.

If a stony concretion have formed in the salivary duct, it must be cut upon within the cheek, and taken out. The continued flow of the spittle prevents the closing of this opening.

["The ducts both of the parotid and submaxillary glands," says Syme (*a*), "are liable to become the seat of calcareous concretions, which are named salivary calculi. Their composition is phosphate of lime, agglutinated by a small quantity of animal matter. They have usually a yellowish-white colour, oval figure, and finely tuberculated surface. They vary in size from that of a millet-seed to that of an almond with the shell. In the parotid duct, they are very rarely met with, but in the submaxillary duct, not unfrequently. [I doubt their frequency even in the submaxillary duct; **Astley Cooper** in his Lectures used to mention having removed one from the mouth of the elder **Cline**, and **Lawrence** in his Lectures (*b*) speaks of having taken out one "which was about the size of a small bean." (p. 765.) In the Museum of the Royal College of Surgeons of England there are only six specimens, either from the duct or substance of the submaxillary gland; but one from the parotid gland; and some small concretions from the tonsils. Besides these I do not know of any other instances, and have never seen one.—J. F. S.] "They occasion pain, swelling, and hardness," continues Syme, "and sometimes impede the flow of the saliva or give rise to the formation of an abscess. In the parotid duct the symptoms thus produced are apt to be confounded with those of rheumatism, tooth-ache, gumboil, or suppuration of the maxillary *antrum*; while under the tongue, they may be occasionally mistaken for those of encysted tumours. In all cases of doubt, it is right to search the duct with a probe, and to feel for the *calculus*, by pressing on the place where it is suspected to be. So soon as a free incision is made, the concretion escapes, together with the fluid accumulated about it. The original situation of these concretions is immediately within the orifice of the ducts; but they have also been found imbedded in the substance of the submaxillary gland, where they excited an increased and unhealthy secretion, with general swelling and hardness of the gland. In such cases the calculus, if distinctly recognised, may be extracted by cutting down upon it, from the mouth." (p. 427.)

Among the specimens at the College (*c*) there is one large submaxillary *calculus* an inch and a half long and three quarters of an inch broad, taken from a very old man, who

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(*a*) Lancet, vol ii. 1830.

(*b*) Principles of Surgery.

(*c*) A descriptive and illustrated Catalogue of the Calculi, &c., &c., contained in the Museum of the Royal College of Surgeons in London. 1845. 4to.

"was conceived to be dying, being nearly choked by the tumour, when in consequence of an effort, the *calculus* was thrown out and he recovered." In another the stone is stated "to have occasioned a quinsy." One specimen was removed after it "had been twelve years breeding," and another "formed in twelve days." (p. 191.)—J. F. S.]

B.—OF BILIARY FISTULA.

(*Fistula biliosa,* Lat.; *Gallenfistel,* Germ.; *Fistule biliaire,* Fr.)

911. *Biliary Fistula* originates in a division of the gall-bladder, or ducts, after they have become adherent to the *peritoneum.* The bile is poured from the fistulous opening, and although its loss be often very considerable, it is rarely that important symptoms are produced. Not unfrequently the fistulous opening closes of itself, in general after the escape of a gall-stone; often it breaks again, and the patient then usually finds himself better. The fistula is mostly situated in the region of the liver; frequently, however, at a tolerable distance from it.

I have observed the case of a woman in which, after severe symptoms, a fistulous opening formed near the navel, and out of it a considerable quantity of gall-stones, of the size of peas, escaped from time to time.

912. The cause of biliary fistula is usually a collection of bile in the gall-bladder, (*Hydrops vesiculæ fellis,*) by which is formed beneath the short ribs a swelling, at first defined, regular, and fluctuating, which slowly increases, and is accompanied with pain, that had existed previous to the swelling, and at first not severe. It often is diminished by pressure, or spontaneously, when the gall-bladder is much distended, in which case part of the bile is forced into the intestine, and is followed by bilious stools, with colicky pain. These symptoms distinguish the filling of the gall-bladder from abscess of the liver. If the swelling of the gall-bladder be considerable, it adheres, by means of the inflammation set up in it, with the *peritoneum,* and forms an opening by ulceration, through which the bile escapes. Gall-stones are usually the cause of this collection of bile. The gall-bladder or the bile-ducts may also be ulcerated by abscess; in which case, after it has opened, pus is discharged, mixed with bile.

[Biliary fistulas, from whatever cause, are very rare. I have never seen a single example of this disease; but I much doubt the possibility of distinguishing its precise origin. It certainly is possible that if, when the bile-duct is stopped, the gall-bladder be over distended, it may adhere to the wall of the belly, and that ulceration may ensue, by which its contents are discharged externally, and the aperture may continue fistulous. But there is in the museum of St. Thomas's Hospital an enlarged gall-bladder, from stoppage of the common biliary duct, capable of holding at least three, if not four pints of fluid, which did not ulcerate, but was mistaken for an abscess of the liver, and tapped once or twice, and also another, in which the duct being stopped, the gall-bladder had become adherent to the *duodenum,* ulceration between them had taken place. and the bile thus finding an immediate passage into the bowel, the gall-bladder ceased to serve as a receptacle, and shrivelled to the size of an almond. And it is in this way probably that the gall-bladder more frequently empties itself than externally.

The aperture by which abscess in the liver discharges itself, may become fistulous, and have the bile flowing from it, at first mixed with pus, but afterwards almost, if not quite pure. My friend Dr. Roots informs me he has seen one case in which, after an abscess of the liver, bile was discharged; and my dresser, Guest, tells me, that he saw in the Manchester Infirmary a man who, two months after falling on his loins, had an abscess burst in the right hypochondriac region, from which pus and bile at first escaped, subsequently only bile; and that he had seen this person alive, and in tolerable condition as to health, eighteen months after the accident, although his motions being very white, it is probable that little bile could have assisted in the process of digestion. —J. F. S.]

913. The *cure* of biliary fistula requires first, the removal of its usual causes, viz., gall-stones (the existence of which is shown by the careful introduction of a probe.) After which the fistula soon closes of itself. For the removal of the gall-stones, the enlargement of the fistulous orifice is necessary, which is best done with catgut, or with a tent, so as not to destroy the adhesion of the gall-bladder to the *peritoneum*, under which circumstances effusion of bile into the cavity of the belly would occur. The fistula must be so much enlarged, that a pair of forceps may be introduced with the left forefinger, the stone grasped therewith and withdrawn; in doing this, care must be taken, in moving the forceps about, that no part of the gall-bladder itself be caught hold of. The opening of the fistula should not be closed, so long as gall-stones are believed to be still there; otherwise the fistula will break out afresh. When all the stones are removed, the fistula usually soon closes with a simple covering bandage; and the scarring may be promoted by careful touching with lunar caustic, and suitable pressure. At the same time such remedies must be employed as will diminish the disposition of the bile to concrete, and will assist nutrition.

C.—OF FÆCULAR FISTULA.

(*Fistula Stercorea*, Lat.; *Kothfistel*, Germ.; *Fistule Stercoraire, Anus contre nature*, Fr.)

Sabatier, Mémoires sur les Anus contre nature; in Mémoires de l'Académie de Chirurg., vol. v. p. 592.

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Scarpa, Sull' Ernie, Memorie Anatomico-chirurgiche. Milan, 1809. fol. Translated by Wishart as A Treatise on Hernia, with Notes. Edinburgh, 1814. 8vo.

Reisinger, F., Anzeige einer vom Prof. Dupuytren zu Paris erfandenen und mit gluchlichsten Erfolge ausgeführten Operationsweise zur Heilung des Anus artificialis, nebst Bemerkungen. Augsburg, 1817. 8vo. With a copper-plate.

Nachtrag in Salzb. medic. chirurg. Zeitung, 1818, No. 18, p. 286.

Brosse, Beobachtung eines mit der Darmscheere von Hrn. Prof. Dupuytren in Hôtel-Dieu zu Paris augestellten Heilungs versuches eines künstlichen Afters; in Rust's Magazin, vol. vi. p. 239.

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Liordat, Dissert. sur le Traitement de l'Anus contre nature. Paris, 1819.

Dupuytren, Mémoire sur une Méthode Nouvelle pour traiter les Anus accidentales, lu à l'Académie Royale des Sciences, en Janvier, 1824; in Mém. de l'Acad. Roy. de Méd., vol. i. Paris. 4to. Also, De l'Anus contre nature, des dispositions anatomiques des effets, du siége du prognostic, du diagnostic et du traitement; in Leçons Orales de Clinique Chirurgicale, vol. ii. p. 193.

Reybard, J. F., Mémoires sur le Traitement des Plaies des Intestins et des Plaies pénétrantes de Poitrine. Paris, 1827.

Hennen, John, Principles of Military Surgery. Third Edition. London, 1830. 8vo.

Lawrence, William, A Treatise on Ruptures. Fifth Edition. London, 1838.

Teale, T. P., Article *Intestinal Fistula;* in Cyclopædia of Practical Surgery, vol. ii. p. 191. London, 1841.

914. *Fæcular Fistula* is an old opening communicating with the cavity of the intestine, which, according to its size, discharges either only

a part of the fæcal matter, whilst the rest passes by the natural passage, or by which all the excrement passes, and then the disease is called an *unnatural* or *artificial anus* (*Anus præternaturalis, artificialis.*) The external opening is mostly round, contracted, and surrounded with radiated creases of skin; its edges are red and irritable; frequently there are several external openings leading to one canal: for the most part, the skin is firmly attached to the muscles, it is rarely degenerated, raised from the muscles, and forming a canal; the ends of the bowel are frequently connected directly with the *peritoneum;* frequently they are retracted, and the *peritoneum* forms a funnel-like elongation.

915. The effect of the fæcular fistula, and in a more advanced degree of the artificial *anus*, upon the whole organism, is very decided. By the escape of the chyle, which passes only through a part of the intestinal canal, is the nourishment lessened, though the appetite be great, and the patient quickly wastes, especially at first. The nearer the artificial *anus* is to the stomach, the more severe are these symptoms. If it be further down, at the lower end of the *ileum* or in the *colon*, more decided stools are passed, and the nourishment is not so much affected. By the continuance of the out-flow, the parts excoriate and become very painful. The mucous membrane of the intestine exposed to the air becomes redder, and less villous, but does not cease to secrete a large quantity of *mucus*. In artificial anus merely mucous fluid of a white colour, and varying consistence, which is secreted from the large intestines, passes through the *rectum*. The lower part of the intestinal canal gradually contracts together, but retains its permeability. BEGIN (*a*) has, however, observed an almost complete closing and wasting of the lower portion of the intestine.

[ASTLEY COOPER (*b*) mentions the case of a man "with a strangulated umbilical hernia, which sloughed, and occasioned an artificial *anus*. As he was recovering from the effects of the strangulation and sloughing, and was allowed to take food in any considerable quantity, it was observed that part of what solids he ate passed out at the artificial *anus* within half an hour after he had swallowed them, and that fluids passed out in ten minutes after they had been taken into the stomach. Although he took sufficient food to support a healthy person, he wasted rapidly, and died in three weeks. On examining his body after death, and tracing the *jejunum*, the lower part of that intestine was found entering the hernial sac, and in it the opening was situated." (p. 52.)]

916. Not unfrequently a prolapse of the intestine is produced suddenly in artificial *anus*, as a consequence of straining, or gradually by ensheathing, which often attains considerable size (nine inches and more.) It occurs mostly only at one end of the intestine, has usually a more or less conical form, is contracted at the base, and its point has an opening through which the stools escape. The protruded part has a red colour, is well moistened with *mucus*, and usually is not very sensitive; frequently a peristaltic motion is observed, as in the intestines, and at first it is so contractile that the slightest touch causes retraction; it increases with straining, and diminishes or entirely recedes in the horizontal posture, or with sufficient pressure. The constant irritation to which it is exposed, thickens and renders it like the external tegument; it even becomes blackish. The protrusion may form adhesions with the opening from which it projects, and may even become strangulated. If the protrusion be of the lower end of the intestine, there escapes from it only a white, mucus-like fluid; but the stools pass out from the side of its base. If both upper

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(*a*) DUPUYTREN, Leçons Orales, p. 211.

(*b*) Lectures on Surgery, vol. iii. TYRRELL's Edit.

and lower part of the intestine protrude at once, there are two projections, and the stools are discharged from the middle of the upper end of the intestine. From this protrusion often arise very painful draggings in the belly, which prevent the patient keeping himself upright, and compel him to bend the upper part of his body almost horizontally forwards. In this complication of artificial *anus*, the symptoms are always more severe, digestion is highly affected, wasting makes quick progress, and leads to *marasmus*, if the local relations of the parts be not changed.

917. Fæcular fistula and artificial *anus* may be consequence of penetrating wounds of the belly, accompanied with injury of the intestine or with a protrusion which runs on to gangrene, also of gangrenous ruptures, of abscesses, of foreign bodies in the intestinal canal, and so on, by which either only one part of the wall of an intestine, or an entire coil of intestine is destroyed, in which case adhesion with the *peritoneum* takes place, at the circumference of the destroyed gut, and the effusion of stools into the cavity of the belly is prevented.

[TEALE gives in his essay a very good tabular account of cases of artificial *anus* resulting from these various causes.]

918. Upon the different position and state of the upper and lower portions of the intestine in artificial *anus* depends, whether the cure can be effected merely by the natural powers, or by the simultaneous assistance of art, or only by the intervention of an operation. The destroyed intestine, together with the corresponding part of the *peritoneum*, to which it adheres, retracts into the belly, where it forms a funnel-like cavity, which, in proportion as it enlarges, directs the passage of the stools from the upper end of the intestine into the lower. This, however, cannot happen in artificial *anus*, which forms after penetrating wounds of the belly, after old umbilical and ventral ruptures, when either the injured gut heals up with the edges of the outer wound, or the hernial sac becomes firmly adherent with the *aponeurosis* and abdominal coverings, and the extensible cellular tissue, which surrounds it in other ruptures, is deficient, consequently the adherent piece of intestine cannot retract into the belly sufficiently to form the funnel-like cavity by which the communication of the two ends of the intestine is produced. The cure of artificial anus in this way most readily occurs, when only part of the wall of the intestine is destroyed; but when both ends of the gut, between which a coil has been destroyed, are so connected and held by the mesentery, that they lie more or less parallel, and form an acute angle, a *projecting partition* is thereby formed which prevents the communication between the upper and lower ends of the intestine. If the projection of this partition cannot be removed by the retraction of the pieces of the bowel, the restoration of the natural passage of the stools is possible by destroying this partition.

The retraction of the piece of intestine specially depends on the movements of the bowel and the dragging of the mesentery, which, stretched like a cord from the back of the partition projecting between the openings of both portions of intestine to the spine, is always striving to retract the piece of adherent bowel. Thus is easily seen the effect which the recumbent posture and motion have upon the cure of artificial *anus*. DUPUYTREN (*a*) had two cases in which, by this dragging, the adhesions of the intestinal portions were torn through, and effusion of fæculent matter into the cavity of the belly caused. Examination after death of persons who have died of other diseases many years after the cure of artificial *anus* either by nature or art, shows the intestine either connected by a fibro-cellular band with the place of the artificial *anus*, or these

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(*a*) Leçons Orales.

connexions destroyed and the intestine floating freely in the cavity of the belly. In a case of artificial *anus* at the femoral ring, in a woman, which withstood the usual remedies, a spontaneous cure took place during pregnancy, (WEDEMEYER,) which DUPUYTREN attributes to the gradual retraction of the intestine from the external opening and the lengthening of the funnel-like cavity.

[LALLEMAND (*a*) had the opportunity of examining an intestine seven years after performing DUPUYTREN's operation for artificial *anus* upon it; and of which the external scar in the skin had twice given way after violent exertion, discharging fetid pus mingled with gas and fæcal matter, but subsequently closed. He gives the following account of the appearances he met with:—"There was found in the left inguinal region an oblique fistulous opening leading into the canal, of the size of a crow-quill. Round this, to the extent of five or six lines, was a thin shining cicatrix, in which wrinkled folds of the surrounding integuments terminated. A portion of *ileum*, not differing from the usual appearance of the intestines, was adherent to the left inguinal region by two slender columns. One of these, four lines long by two in width, contained the canal of communication between the fistula and the cavity of the intestine. This canal passed through the inguinal ring, which was short and nearly direct. The other was an ordinary slender fibrous adhesion. There were several ulcerations of the mucous membrane towards the ileo-cæcal valve. As soon as the fistulous communication had passed through the ring, it began to enlarge and assume the funnel-shape, and was quickly lost in the cavity of the intestine. When the latter, which presented the usual circular figure was laid open, a slight prominence marked the situation which had been occupied by the edge: the mucous membrane was just the same here as elsewhere."

DUPUYTREN (*b*) himself also states that on examining the bodies of many persons who had been subject to artificial *anus*, but died years after of other diseases, instead of finding the intestine fixed to the wall of the belly, he saw it free and floating in the cavity. "I should," says he, "have fancied I had been mistaken, had not the patient's identity been indisputable, and had I not discovered a fibrous cord stretched from the point of the abdominal wall corresponding with the accidental *anus* up to the intestine. This cord, some lines in diameter and some inches in length, larger at its extremities than in its middle, covered with *peritoneum* and entirely formed of cellular and fibrous tissue, without any cavity, was evidently the progressive elongation of the cellular tissue which had united the intestine to the wall of the belly, and the cause of this lengthening could only be the constant dragging of the intestine by the mesentery, in the different motions of the body during life." (p. 208.)

The following account of the dissection of a case of artificial *anus*, after mortified strangulated rupture, given by SCARPA (*c*), explains the formation of the funnel:—"I found," says he, "that the great sac of the *peritoneum* had not only become firmly adherent to the portion of the intestinal tube, which had been unaffected by the gangrene behind the inguinal ring, and, properly speaking, in the cavity of the *abdomen*, but likewise that this sac of the *peritoneum*, like a membranous funnel, (*imbuto membranoso*,) extended from the cavity of the *abdomen*, through the inguinal canal, into the fistulous tube communicating externally by a narrow hole in the groin. * * * Having divided longitudinally the narrow fistulous canal, and the membranous funnel, I saw distinctly that the two orifices of the intestine had remained parallel, without being at all turned towards each other; and a ridge (*promontorio*) projected between them, which would have been sufficient of itself to prevent the direct passage of the *fæces* from the superior to the inferior orifice. The alimentary matters must therefore have been poured from the upper end into the membranous funnel, and have passed thence, by a half circle, into the lower end of the intestine." Upon the same point DUPUYTREN observes:—"In examining the opening of the skin and the bottom of the artificial *anus*, a sort of funnel is discovered, the dispositions of which have been best observed and described by the celebrated SCARPA. It is formed of parts, which inflammation and contact have reduced to the same nature, to wit, that of mucous membrane. Its point is at the skin, its base at the intestine; its length, direction, form, and dimensions vary to infinity, and have the greatest influence on the cure of the complaint. The greater its extent and capacity, the greater disposition, in general, has nature to cure this ailment, or to second the efforts of art for that purpose. At the bottom of the funnel are found the most remarkable and important circumstances relating to the artificial *anus*. There are the orifices of the two ends of the intestinal canal, and there the partition by which they are separated. Of these two orifices, the one belongs to the

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(*a*) Répertoire général d'Anat. et de Physiol. Patholog., vol. vii. p. 133.

(*b*) Leçons Orales.

(*c*) Sull' Ernie, Mem. iv. sect. iv.—I have to acknowledge making use of LAWRENCE's translation (from his work on Ruptures) of this portion of SCARPA as well as that from LALLEMAND.—J. F. S.

upper part of the intestine, is always penetrated by the food and stercoral matter, is the most free and widest of the two. The other is the continuation of the lower end of the bowel, and as it does not receive either alimentary or stercoral matter, or only in very small quantities, it is usually narrow, contracted, and difficult to find. To these orifices succeed the extremities of the intestine, villous, and lined with mucosities within, smooth, covered with *peritoneum*, and bathed in serosity without, buried in the belly, sometimes crossing, sometimes twisting about each other, sometimes running parallel, but most commonly separating from each other at an angle more or less acute; and they are lost by curving more and more in the circumvolutions of the intestinal canal. On examining the space between the two orifices, a projection, more or less distinctly angular is perceived, and more or less near the entrance of the funnel just mentioned. This projection, the so-called spur (*éperon*) already perceived and pointed out by SAVIARD and MORAND, results from the application and union, at an acute angle, of the corresponding walls of the two parts of the intestine which abut in artificial *anus*. * * * After a time this spur does not divide the bottom of the funnel into which the two ends of the intestine open, into two equal parts. Continually pressed on by the matters which the upper end brings down, this fold yields to their pressure, and is gradually carried towards the lower end, upon which it advances more and more, till at last it covers its orifice with a sort of valve, which hermetically closes its entrance, and renders its discovery very difficult. Towards the intestinal cavity the spur has constantly a crescentic form, of which the angles directed from the concavity towards the convexity of the new curve of the intestine, are confounded with it, and gradually lost either in the walls of the organ or on the edges of the deepest part of the wound of the belly. On the abdominal surface it is seen doubled, and the two equal halves of which it consists separate and receive the *mesentery* in their interval." (p. 202–5.) "Thus," says LAWRENCE, "the two portions of the bowel lie near together, but are not adherent; they are separated by the ridge called by SCARPA *promontorio*, and by the French *éperon*. If we introduce a finger into each orifice, and bring the fingers together, they are separated merely by the sides of the two portions of intestine. When it is described that they are kept apart by an intervening partition, we must remember that there is nothing but the intervening tunics. We might pass an instrument from one end of the bowel into the other, and thus cause a direct communication between them by perforating their coats; but as the bowels are simply contiguous without adhering, we should make a double wound into the cavity of the abdomen." (p. 383.)]

919. The *treatment* of fæcular fistula or artificial anus, consists at first merely in attention to the proper discharge of the stools, in covering the opening with a wad of lint, and the removal of all pressure from it; good nourishing food, and easy of digestion, should be given, and frequent clysters and gentle purgatives. If there be externally several fistulous passages, they must be slit up, the irritation and callosity removed by poulticing and cleanliness of the dressings, and hard, tough, dry callosities, which will not disperse, are to be removed with the knife. If the opening contract too quickly, or the stools cannot escape sufficiently, the opening must be enlarged with sponge-tent or the knife, which, however, is less safe, as the adhesions of the intestine may be easily divided. A sufficiently large pad should be put into the opening to prevent it narrowing; and its introduction is also the only mode of preventing the protrusion of the bowel. If this occur, attempts must be made to return it, and if that be not at once possible, we must try to effect it by continued pressure with a bandage. The patient must be kept in bed, and avoid all exertion. In strangulated protrusion, the stricture must be carefully divided at the root of the protruded part. If under this treatment the excrements be gradually discharged by the natural passage, and so continue for some time, the opening may be allowed to close, gradually, except the patient feels pain in the belly, or uneasiness from collection of stools; it is, however, advisable to keep up a small opening for some time longer by the introduction of a bougie. If the opening close too quickly, or if the stools collect largely at the opening of communica-

tion of both ends of the intestine, severe pain occur at the region of the artificial *anus*, painful distension of the belly, vomiting, and even bursting of the distended bowel, and effusion of fæcal matter into the cavity of the belly. In this case, if the opening be not yet entirely closed, an elastic tube must be introduced, through it, into the upper portion of the intestine, or escape must be afforded to the collected excrement by a sponge-tent or by incision.

[I have had but one case of artificial *anus*, and that in a boy of about ten years old, and at the navel, the middle of the scar in which projected a little beyond the surface and was perforated by a small hole of sufficient size only to admit a probe. Through this hole a very small quantity of dark-coloured fæculent matter daily escaped, and its acridity kept the edge of the aperture constantly sore. Neither how this had originated (though probably from abscess in the navel) nor how long it had existed can I state, having mislaid my notes; but the child was in tolerable health, though not very stout. Various means were tried without success to induce the hole to heal, among which attempting to form a scab with chalk and calamine powder, and the use of a pad and pressure. It was, however, finally cured by tying a ligature around it as low into the hollow of the navel as it could be depressed. This separated without any inconvenience, the wound healed and the fistula was cured.

King (*a*) considers that similar cases (of which he gives two) with that I have just mentioned, depend on a communication with the *diverticulum ilei.* and founds his opinion on the analogy which exists between the umbilical vesicle of the human subject and the yolk sac of the chick *in ovo*; in the latter of which "omphalo-mesenteric vessels communicate between the yolk sac and mesentery; and there is also a trace of a tube, on the plan of a *diverticulum*, opening into the intestine." (p. 467.) The correctness of this view was fully confirmed by examination after death of the first case he relates, of this umbilical fistula which had been cured by making the edges raw and pinning them together. On examination, "a *diverticulum*, about three inches long, was found adhering to the *umbilicus*; and an adventitious cord appears to have compressed the *ileum*, just below its connexion with the *diverticulum*." (p. 472.)

I have also seen another case of aperture, in the navel of a woman about twenty-five years old, from which there was a constant flow of colourless fluid, and free from smell, in such quantity as to wet a napkin through once or twice a day. Whence this fluid came I cannot determine, it could scarcely have been from an intestine; I once thought it might have been obtained from the bladder by passing through an *urachus*, but it had not any urinary character. She had been subject to it for years, but her health was not at all affected and she was only inconvenienced by it.—J. F. S.

In concluding his review of Dupuytren's operation for artificial *anus*, Lawrence observes:—"Cases of artificial anus must be much more numerous in Paris than in London. Dupuytren employed his method in between twenty and thirty instances within a short time. No opportunity has occurred to me of putting it into practice, either at St. Bartholomew's Hospital or elsewhere for several years; and I believe that it has hardly been employed at all in this country." (p. 415.)]

920. If with this treatment the cure of the artificial *anus* be not possible, because the partition between the two openings of the intestine projects too much, the partition must be cut off with the *intestinal scissors* (*enterotome*) invented by Dupuytren. For this purpose the position of both ends of the gut are to be most carefully ascertained with a thick sound oiled, or with the finger; to do which, previous enlargement of the external wound with sponge-tent is often necessary. The fleshy growths, which, however, must be carefully distinguished from the intestinal protrusion, are to be removed with caustic, ligature, or scissors. Finding the two openings of the intestine is often attended with much difficulty, because the partition is always pressed against the opening of the lower part by the stools flowing down from the upper, and the former is at last completely closed. The more readily the openings of both portions of intestine are found at the

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(*a*) On a Fæculent Discharge at the *Umbilicus* from communication with the *diverticulum ilei*; in Guy's Hospital Reports, Second Series, vol. 1. 1843.

bottom of the artificial *anus*, the more favourable is the *prognosis*. If thick probes (female catheters) be used for examination, they must be connected externally together after their introduction into the upper and lower end of the intestine, and turned upon their axes, which movement is opposed by the partition. When the ends of the intestine are discovered, the arms of the intestinal scissors should be so introduced into both ends of the gut upon the finger, or on the hollow sound, that when closed at least two and a half inches of the partition shall be taken hold of. The same turn is to be made with the introduced arms of the scissors as with the sounds, to ascertain that they have entered completely. By the screw on the handle of the scissors, they are to be closed only sufficiently to produce a *little pain;* the handle of the forceps is to be wrapped in linen and fastened to a T bandage. Every day, or every two days, the forceps are to be screwed a little tighter. If little pain follow it is well, but if severe the forceps must be loosened. The patient must take light nourishment, and soothing clysters may be given. Against pain in the belly, oily mixtures, soothing clysters, and applications are to be used, and in inflammatory symptoms, the proper antiphlogistic remedies. According to Dupuytren's observations, however, these symptoms rarely occur.

Dupuytren's first intestinal scissors crossed each other with a disjoinable lock; but Seiler has modified them by making the arms parallel (*a*).

Liordat's *emporte-pièce*, for the purpose of removing a larger piece of the partition (*b*).

Reybard (*c*) seizes the partition between the upper and lower end of the intestine with forceps, and divides it by pushing forward his enterotome. The forceps are left attached to produce the union of the corresponding wounds of the intestine.

Delpech's enterotome (*d*) differs from that of Dupuytren in each of its branches, being a little curved, and ending in an oval plate an inch in length. When introduced and brought together by the screw, in consequence of the curved form of the branches, such portion only of the intestinal partition is compressed as is enclosed between the two plates. The object is to destroy a smaller portion of the partition at one time, and to repeat the process until a sufficient opening shall be made in it. The form of the opening, Delpech also holds to be preferable to the lengthened slit made by Dupuytren's instrument.

Desault was aware of the partition between the two ends of the intestine preventing the passage of the excrement, and endeavoured to retract and diminish the protrusion, partly by closing the external opening with a plug, partly by the introduction of long rolls of charpie into the two ends of the gut, which he gradually brought straight, pressed back, and diminished. With the same object Schmalkalden (*e*) made an opening into the projecting partition, which he endeavoured to preserve by introducing tents, and by careful notching, to increase and establish the natural passage for the excrement.

[Our American brethren seem disconcerted at the invention of this mode of treatment being generally assigned to Dupuytren. After referring to Desault's practice just mentioned, Dr. Gibson (*f*) observes:—"A more expeditious and less troublesome operation was proposed and successfully executed by Dr. Physick between the years 1808 and 1809. * * * An operation similar to that of Dr. Physick was afterwards performed by Dupuytren in Paris, and to him the merit of the proposal is awarded by European writers without the slightest foundation." (p. 316.) Now certainly, though our French neighbours are occasionally not particular in claiming that to which they are not strictly entitled, yet in the present instance, whatever may have been awarded to Dupuytren, he himself mentions in a note to his Memoir, Schmalkalden's dissertation, though without giving particulars, and also specially quotes Dr. Physick's plan of treatment from Dorsey's Elements of Surgery, vol. ii. p. 67. He is therefore, so far at least as Dr. Physick is concerned, entirely free from misappropriation. It cannot, however, be denied that Physick's account is merely the recital of a case and of a novel operation for its relief, without entering into the consideration of the nature and

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(*a*) Seiler, above cited, pl. vi. f. 14.

(*b*) Above cited. (*c*) Above cited.

(*d*) Froriep's Notizen, No. 583. p. 169.—Chirurgische Kupfertafeln, pl. cclxviii.

(*e*) Above cited.

(*f*) Institutes and Practice of Surgery, vol. ii. Philadelphia, 1827.

circumstances of artificial *anus*, to which first **Scarpa** and subsequently **Dupuytren** have paid especial attention, and of which they have given very excellent account. **Physick**'s operation is, however, well worthy of being better known, and it is therefore here given from Dr. B. H. **Coates**'s report (*a*):—

"The two ends of the intestines," says **Coates**, "were found, by careful examination, to adhere to each other for some distance, and the form thus presented has been compared in this case to that of a double-barelled gun. The next method proposed by Dr. **Physick**, was to cut a lateral opening through the sides of the intestines when they were adherent. But not knowing the extent of the adhesion inwards, he thought it necessary to adopt some preliminary measures for ensuring its existence to such a depth as might admit of the contemplated lateral opening, without penetrating the cavity of the *peritoneum*. By introducing his finger into the intestine through one orifice, and his thumb through the other, he was enabled to satisfy himself that nothing intervened between them but the sides of the bowels. He was thus enabled, without risk, to pass a needle, covered with a ligature, from one portion of the intestine into the other, through the sides which were in contact, about an inch within the orifices, which ligature was then secured with a slip knot. This operation was performed on the 28th January, 1809. The ligature was nearly drawn sufficiently tight to ensure the contact of those parts of the peritoneal tunic, which were within the noose. When drawn tighter, it produced so much pain in the upper part of the *abdomen*, of a kind resembling colic, that it became necessary immediately to loosen it. The ligature in this situation, gradually made its way by ulceration through the parts which it embraced, and thus loosened itself. It was at several periods again drawn to its original tightness. After about three weeks had elapsed, concluding that the required union between the two folds of *peritoneum* was sufficiently insured, Dr. **Physick** divided with a bistoury all the parts which now remained included within the noose of the ligature. No unfavourable symptom occurred in consequence. On the 28th February, the patient complained of an uneasy sensation in the lower part of the *abdomen*, and on the 1st of March he extracted with his own fingers some portions of hardened *fæces* from his *rectum*. On the 2nd March two or three evacuations were produced in this manner. On the 3rd an enema, consisting of a solution of common salt, was directed to be given twice every day. The first of these occasioned a natural stool, about two hours after its administration. The same effect was produced on the 4th, 5th, and 6th, and the discharges from the orifices in the groin now became inconsiderable. Adhesive plasters, aided by compresses, were employed, not only to prevent the discharge of *fæces* from the artificial opening, but with the additional object of procuring the adhesion of the sides. This last effort was unsuccessful. On the 24th June, an attempt was made to unite them by the twisted suture. Pins were left in for three days, and adhesion was in fact effected; but owing to the induration of the adjacent parts, the wound again opened. On the 27th July, a truss of the common construction, furnished with a very large pad, and surmounted by a large compress, was applied to the wound. By these means the discharge of *fæces* from the groin was completely prevented, and the patient had regular evacuations *per anum*, except when from improper diet or cold, he became affected with *diarrhœa*. At such times, a small portion of the mere fluid matter escaped by the sides of the compress. Not satisfied with this state of things, Dr. **Physick** made several attempts to improve the patient's condition. On the 2nd August, a mould of the parts was taken in plaster of Paris, and being covered with buckskin, was employed as a pad for the truss. This expedient answered extremely well, as long as the patient continued in the same posture in which the mould was made; but as soon as the form of the parts was altered by a change of position, *fæces* escaped from the orifice. A bandage was then applied to the body, furnished with a thick compress, and having that part of it which crossed the patient's back formed of elastic extensible wire-springs, such as are used in braces. This also, however, proved ineffectual. The truss, with a compress and a large pad stuffed in the common way, was then reapplied, and found to answer completely the purpose of preventing the discharge of *fæces*, the hope of an entire closure of the orifice being abandoned. On the 10th of November he was discharged from the hospital in good health and spirits, and applied himself, with very good success, to acquire the profession of an engraver." (p. 271–72.)]

921. When the intestinal scissors have divided the partition, which happens usually in from seven to ten days, and the separated part of the bowel is found between its arms, soothing clysters must be con-

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(*a*) Account of a Case in which a new and peculiar operation for Artificial Anus was performed in 1809 by **Philip Syng Physick**, M.D., then Professor of Surgery in the University of Pennsylvania. Drawn up for publication in North American Med. and Surg. Journal, vol. ii. p. 269.

tinued, and closing of the fistula only attempted, when the relief of the bowels has been effected for some time in the natural way, even without injections. The closing of the fistula (often the most difficult part of the whole treatment) may be effected by quiet, by a *moderate* compressing apparatus with variously-formed pads and elastic belly-band, by touching with lunar caustic, by pressing the edges of the fistula together with a peculiar compresser (*a*) invented by **Dupuytren**, by sticking plaster, by suture, or by the removal of the whole circle of mucous membrane preventing adhesion at the mouth of the fistula, and even by detaching part of the external coverings above the opening, and laying it before it. In general a small fistulous opening remains for years, then only occasionally do a few drops of intestinal dirt escape, and afterwards it closes of itself. In those cases where artificial *anus* cannot be cured, various proposals have been made to catch the excrement. The most simple, and in most cases most suitable, is a belly-band, which, instead of a pad, is furnished with an ivory plate having an opening in its middle, and connected by means of a cylinder of elastic rosin, with a silver vessel, out of which the escape of the stools is prevented by a valve (*b*).

Dieffenbach (*c*) at last cured an artificial *anus* arising from a lance wound, which had withstood every plan of treatment, in the following manner:—He destroyed with the hot iron not only the edge of the intestine adhering to the opening, but also a considerable portion of the intestine within the belly, and in every cauterization the *peritoneum* participated. This burning was free from pain. He first burned the edges of the intestine; some days after, he introduced a curved hot iron, of the thickness of a feather-stem, through the hole, into the cavity of the intestine and carried it round. The opening gradually became smaller; granulations sprung from within, and by repeated burnings with smaller hooks, which he introduced to the extent of an inch about the inner edge of the opening, it diminished to the size of a small fistula. This also closed by the repeated introduction of a heated fine silver probe. The patient was perfectly restored after nine months.

922. If an unnatural anus communicate with the *cæcum*, and arises from ulceration, neither funnel-shaped lengthening of the *peritoneum*, nor projecting partition are produced, as after gangrene of a coil of intestine; and it is therefore more difficult to cure. Suture is useless. The skin has been detached about the opening, and brought together with some stitches, but equally without avail. Autoplasty has been attempted, but the laps have sloughed. The skin about the opening may be pared off, without the inner parts being touched, so that the escape of fæculent matter may be prevented, and that the dragging of the threads may be better borne; otherwise, for the purpose of rendering the tearing and dragging less, semicircular cuts may be made in the skin, of which the concavities should be directed towards the unnatural anal opening, upon which, when the operation is finished, slight pressure may be made by graduated compresses. **Velpeau** (*d*) also proposes the introduction of a tube of gum elastic, provided with several holes, through which waxed threads are to be carried, from within outwards, through the previously pared edges of the opening. When the aperture has scarred, the threads are to be cut through, and then the tube being set free, passes by stool; a mode of treatment similar to that proposed by **Reybard** for the union of wounds of intestines (*par.* 525.) Perhaps **Dieffenbach**'s above-mentioned burnings may be applicable to such cases of artificial *anus*.

(*a*) **Breschet**, above cited, pl. iii. fig. 2.

(*b*) **Collier**, in **Fothergill**'s Medical and Physical Journal, 1820, June.

(*c*) **Casper**'s Wochenschrift, für die ges. Heilk., 1834, p. 265.

(*d*) Mémoire sur l'Anus contre nature dépourvu d'éperon, et sur une nouvelle manière de le traiter. Paris, 1836.

D.—OF RECTAL FISTULA.

(*Fistula Ani*, Lat.; *Mastdarmfistel*, Germ.; *Fistule à l'Anus*, Fr.)

Pott, Treatise on Fistula in Ano; in his Works by Earle, vol.

Desault, Œuvres Chirurgicales, vol. iii. p. 380.

Detzmann, Dissert. de fistula ani. Jenæ, 1812. 4to.; with plates.

Reisinger, F., Darstellung eines Verfahrens, die Mastdarmfistel zu unterbinden. Augsburg, 1816. 8vo.

Kothe, Darstellung und Würdijung der Kurmethoden der Afterfisteln; in Rust's Magazin, vol. i. pt. ii. p. 259.

Schreger. Ueber die Unterbindung der Mastdarmfisteln; in his chirurgische Versuchen. Nürnberg, 1818. vol. ii. pt. i.

Copeland, Thomas, Observations on the principal Diseases of the Rectum and Anus. London, 1814. 8vo.

Bell, Charles, A Treatise on the Diseases of the Urethra, Vesica Urinaria, Prostate, and Rectum. Third Edition; with Notes by Shaw. London, 1822. 8vo.

Brodie, Sir Benjamin, Lectures on Diseases of the Rectum; in Medical Gazette, vol. xviii. 1836.

923. Under the term *Rectal Fistula* is comprehended every fistulous suppurating passage in the neighbourhood of the *rectum*, in which either merely the tissue surrounding the outer walls of that gut is destroyed. or the fistulous passage communicates with the cavity of the *rect m* Rectal fistulas are therefore distinguished into the *perfect*, *(F. ani completæ,)* and *imperfect*, *(F. ani incompletæ,)* according as they have an external and internal opening communicating with the cavity of the *rectum;* or they have an internal or external opening alone, *imperfect internal (external blind)* and *imperfect external (internal blind) rectal fistulas.* They also present numerous other differences; the fistulous canal may extend far up into the cavity, may be accompanied with many external openings, may extend far beneath the external skin, and be accompanied with callosities and hardening, with foreign bodies, with disease of the neighbouring parts, the bladder, *urethra*, *vagina*, and so on, or even with *caries* of the bones of the *pelvis.*

924. The causes of rectal fistulas, are injuries of the internal coat of the *rectum* by foreign bodies which pass with the stools, producing inflammation and suppuration, suppurating bunches of hæmorrhoids, by which the internal membrane of the *rectum* is destroyed. These fistulas generally form slowly; the patient has for a long time itching at the *anus*, and a knobby swelling forms about it, which often merely empties itself by a small opening, or the fistula has little disposition to break externally, but rather spreads upwards, and may be connected above by a second opening with the *rectum* (*a*); or an abscess may form about the *anus* from hardening, from injury, from burrowing of pus from another part, which deprives the exterior wall of the *rectum* more or less completely of its cellular tissue. These abscesses are often critical, and the patient is thereby freed from other complaints, from affections of the chest and so on; often they are merely consequent on gorging of the hæmorrhoidal vessels, from diseases of the breast and liver.

925. The condition of the fistula is in part shown by the nature of its origin, the fæcal or merely purulent discharge, and the passage of intestinal gas from it, especially after examination with the probe.

926. According to the observations of Sabatier, Larrey (*b*), and

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(*a*) Schreger, Annalen des chirurgischen Clinicum's auf der Universität zu Erlangen, 1817, p. 92.

(*b*) Mémoires de Chirurgie Militaire, vol. iii. p. 415.

Ribes (*a*), the internal opening of rectal fistula is most commonly found immediately above the part where the internal membrane of the *rectum* joins the external skin, rarely about, but never higher than five or six lines; at least such was the case in seventy-five corpses in which Ribes examined rectal fistulas.

[Astley Cooper mentions a case of fistula which had a very remarkable course:—" A man died of a discharge from a sinus in the groin, having also a *fistula in ano*; and upon tracing the sinus in the groin, it passed under Poupart's ligament, and taking the course of the *vas deferens*, descended into the *fistula in ano*." (p. 326.)]

927. These observations, which agree with my own experience, must assist the Surgeon in the examination of rectal fistulas. A thickish probe should be introduced horizontally and nearly parallel with the *perinæum*, at least in women, because in them the opening of the *rectum* is less drawn in, than in the male, in whom the probe must be directed rather more upwards. The probe should be introduced into the canal of the fistula, and without leaving it, carried, towards the lower end of the *rectum*, where sometimes the opening is found, and the probe may be felt penetrating into the gut by the forefinger therein introduced. In many cases when the patient protrudes the *rectum*, and the edges are drawn aside with the fingers, the internal opening of the fistula may be seen. If the examination be not thus proceeded with, the internal opening must be sought at the bottom of the fistula; the wall of the *rectum* may be easily penetrated. If several external fistulous orifices be present, they all must be examined in order to determine whether they be connected with each other. The examination must be repeatedly made whilst the patient is on his side, with the trunk bent forwards, upon his back with the thighs drawn up, and whilst standing. Catgut bougies and injections may also be employed for the close examination of the state of the fistula. In the examination of incomplete internal fistula, those parts at which the patient has always specially felt pain, or which are indicated by softness, hardness, or laxness, must be carefully examined, partly with the finger and partly with the probe, which should not be hook-like and curved, but straight, as the canal of the fistula often stretches upwards (*b*) (*par.* 924.) The part, which about the *anus* is harder and painful to the touch, shows the bottom of the external blind fistula. The colour of the skin is here usually changed, and on pressure pus flows into the *rectum*. These symptoms, however, are often wanting, and the patient merely feels pain.

928. The cure of the rectal fistula which has an internal opening, is only to be effected by division of the *sphincter* muscle, and the partition between the fistulous passage and the gut. If the canal of the fistula extend far up, a relapse is more certainly prevented by beginning the division from the external opening. Many observations support this, and there is the proof that the most important part of the operation for rectal fistula consists in the division of the *sphincter* muscle, whereby the collection of fæcal matter in the *rectum* is prevented, and the union of the walls of the fistula possible. An imperfect external rectal fistula does not always require this division of the partition, because if in such case due care be taken for the proper escape of the *pus*, the stripping of the *rectum* is not so considerable as to render doubtful the connexion of the walls of the fistula with the neighbouring parts. The operation for rectal fistula must be

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(*a*) Recherches sur la situation de l'Orifice interne de la Fistule à l'Anus et sur les parties dans l'épaisseur desquelles ces ulcères ont leur siége; in Révue Médicale, Historique et Philosophique. Paris, 1820, livr. i. p. 174.

(*b*) Schreger, above cited, p. 98.

considered to be contra-indicated, when it seems to be a vicariously secreting organ, by which other ailments are lessened or removed, (here the annoyance of the patient may be relieved by enlarging the external opening of the fistula, and by cleanliness,· and the cure must be proceeded in at least not without careful preparation, according to the circumstances of the patient,) and if it be connected with other diseases of the pelvic bones, of the bladder, of the prostate gland, of the *vagina* and so on, or with *phthisis*, or incurable disease of the liver, which cannot be removed by the operation for fistula. Those rectal fistulas are to be considered incurable which are very old, have many openings, are connected with ruptures and callosities, where too much must be done to destroy them, and where the internal opening is out of reach. If the fistula have existed a long while, the operation must not be undertaken without the introduction of issues; and also if the fistula and the neighbouring parts be much swollen and inflamed, the operation must be withheld till these symptoms are put aside.

[The following observations of BRODIE should always be borne in mind when considering the propriety of operating for fistula:—"In those cases in which a *fistula in ano* occurs in connexion with some organic disease of the lungs, or liver, I advise you never to undertake the cure of the fistula. No good can arise from an operation under these circumstances; but if you perform it, one of two things will happen: either the sinus, although laid open, will never heal, or, otherwise, it will heal as usual, and the visceral disease will make more rapid progress afterwards, and the patient will die sooner than he would have done if he had never fallen into your hands." (p. 186.) And ASTLEY COOPER also observes:—"The Surgeon often brings discredit upon himself by operating in these cases, in the last stage of *phthisis*, when no operation ought to be performed, and when it is impossible that the disease can be cured: therefore that death which is the result of pulmonary disease, is falsely attributed to the *fistula in ano*." (p. 328.)]

929. The abscesses which form in the neighbourhood of the *rectum* are either phlegmonous, defined and accompanied with throbbing pain, or they arise gradually in form of little not very painful knobs, or they occur after the protrusion of the *rectum*, with simultaneous collection of fæcal matter and pus, are of great extent, and commonly produce, especially with persons of bad constitutions, wasting suppuration and gangrenous destruction. In the former case leeches and soothing applications are to be employed, and the abscess should be opened early with the lancet, to prevent the destruction of the cellular tissue in the neighbourhood of the gut; and if the canal do not communicate with the gut, it may be hoped that simply by the covering bandage and the use of soothing applications, or in old fistulas of this kind, by injections exciting inflammation, the cure may be effected. In hard and little painful swellings, soothing poultices and dissolving plasters may be used; they should be opened when soft and the further treatment be such as in the former case. But if in internal blind fistula the outer wall of the *rectum* be exposed to some extent, the division of the partition between the fistulous passage and the gut is requisite. When a large abscess has formed about the *anus*, if it have arisen from tearing of the wall of the *rectum*, a sufficiently large opening (but not a transverse cut, which would at the same time divide the wall of the gut) must be made, attention paid to the free escape of the *pus*, to the necessary means for supporting the powers, and afterwards when the fistulous passage has become more contracted, the division of the partition between the fistula and *rectum* must be proceeded with. (SABATIER) (*a*).

(*a*) Médecine Opératoire. Nouv. Edit., 1822, vol. ii. p. 309.

"In speaking of large abscesses which sometimes form high up by the side of the *rectum* and above the *sphincter* muscle, **Brodie** makes the following excellent observations:—" When the existence of such an abscess is ascertained, you ought without delay to puncture it; otherwise not only will the patient have to undergo a great deal of unnecessary pain, but the abscess will extend itself in the *pelvis* until it attains an enormous size. You must ascertain the situation of the abscess, by observing to what part the pain is referred, and by examining the *rectum* with the finger. Then introduce a lancet through the external skin by the side of the *anus*, in the direction of the abscess, until the matter flows. Frequently the abscess is at such a depth that the lancet does not reach it until nearly the whole of the blade has penetrated the soft parts; and sometimes an ordinary lancet is scarcely of sufficient length to accomplish what is wanted. You are then to introduce a probe-pointed bistoury through the opening thus made, and divide the *rectum* at the lower part of the abscess, carrying the incision downwards, so as to include the *sphincter ani* muscle, as you would in an ordinary case of fistula. These incisions make a free opening into the abscess, which is immediately emptied of its contents. The wound is then to be dressed in the ordinary way, and nothing more is wanted. It is quite unnecessary, in these cases, to lay the whole abscess open into the *rectum;* the free division of it at the lower part is sufficient; and if the incision were to extend further, it might give rise to a dangerous hæmorrhage from large blood-vessels beyond the reach of the finger. I have met with abscesses, such as I have now described, containing from half a pint to a pint of matter. I have had no opportunities of dissection so as to ascertain their exact locality; but from examinations made with the finger, after they have been opened, I am led to suspect that their usual situation is between the *levator ani* muscle and the *pelvis*, and that the division of the lower part of this muscle, as well as that of the whole of the *sphincter ani*, is necessary to the cure.

"These large *pelvic* abscesses occur in some instances as the original and only malady. In other cases, as I explained in my last lecture, they are the result of an abscess lower down, or a common fistula. I have met with several cases such as I am about to describe. I have been consulted concerning a fistula near the lower part of the *rectum*, which I have layed open in the usual manner. But, after some time, I have found that the parts showed no disposition to heal, or that they healed imperfectly, and that there was a discharge of pus much greater than could be accounted for from the apparent extent of the sore surface. I have thus been led to make a further examination; and at the upper part of the *sinus* which had been previously laid open, I have discovered a small orifice, through which a long probe might be passed to a great depth. I have laid open the lower part of this upper abscess into the *rectum*, and could then introduce my finger so as to feel the broad inner surface of the *pelvis* on one side, and what seemed to be the *levator ani*, on the other. After this second operation, the purulent discharge has immediately become much reduced in quantity, and in the course of a short time the patient's cure has been completed." (p. 186.)]

930. The usual modes of operating on rectal fistulas are *incision* and *ligature*, as the early mode of treatment with the hot iron or caustic is now put aside, and *cutting out* the fistula must be confined to those cases in which it is connected with scirrhous or carcinomatous degeneration.

931. For the operation on the rectal fistula by cutting a quantity of instruments have been invented, as the syringotome, the curved bistoury, the special apparatus of **Drummond**, **Rettler** and **Brambilla**, the fistula-knife of **Pott**, **Savigni**, **Remm**, **Dzondi**, and others. But the most simple and certain proceeding is, when, for cutting the wall of the fistula only a *common straight bistoury*, a *grooved probe* without a blind point, and a *wooden gorget* are used. After having emptied the *rectum* with a clyster and removed the hair in the neighbourhood of the fistula, the patient is to be laid in his bed, or on a couch upon the side of the fistula, with the thigh of the affected side stretched out straight, and the other bent towards the pelvis. The grooved probe is to be introduced through the canal of the fistula and its internal opening into the *rectum*, where it is found by the finger which has been therein introduced. The oiled gorget is then to be passed into the *rectum*, its hollow directed towards the side of the fistula, and the probe pressed against it. The probe

and gorget being felt to touch distinctly, are to be held with either hand, and both moved together. The probe is given to an assistant, who at the same time separates the buttocks, and the gorget being pressed against it, a straight bistoury is to be introduced along its groove, till it reaches the gorget, and in drawing out the bistoury all the parts between the probe and the gorget are divided, which is shown by the probe and gorget being drawn out through the wound without disturbing their contact after the incision is completed. If the canal extend higher than the internal fistulous opening, a pair of blunt scissors should, according to the advice of some, be introduced into the wound, upon the forefinger, and the remaining partition divided. This, however, is according to foreign and home experience not indispensable (*par.* 928.) If the internal fistulous opening be very deep, a fine flexible, silver, hollow sound may be introduced by the fistula into the *rectum*, its end brought down out of the gut with the forefinger, and the parts lying upon it divided with a bistoury pushed along the groove.

Further observations on the seat of the internal opening in rectal fistula must decide, whether this be not always connected as above said, (*par.* 928,) and whether the division of the wall of the fistula from the inner opening be sufficient for the cure although the fistulous canal extend higher.

[My common practice in operating on rectal fistula, has been for years, to use a soft silver director which will bend. Having introduced the forefinger of one hand into the *rectum*, I pass the director through the fistulous passage, and if, as is generally the case, there be a hole in the gut, into the *rectum*; but if there be not an opening, or if it cannot be readily found, I bore the end of the director against the wall of the gut, upon the finger introduced, and thus speedily penetrate into the cavity of the *rectum*. Having thrust the end of the director well through, I bend it round with the top of my finger, till I have brought it through the *anus* externally, and then thrust it a little further, till its point rests upon the opposite buttock. Having both ends of the director, and both apertures of the fistula well in sight, I divide the *sphincter* and its tegument, by running a pointed curved bistoury along the groove of the director. I think this mode of proceeding is best, because it shows to what extent the parts are divided; and also that thereby the upper part of the wall of the fistula tears, and is therefore less likely to unite by adhesion, then when clean cut, as quick union is not desirable. **Brodie** also recommends the practice of bringing the end of the director through the *anus*, and dividing upon it.

If I do not bring the probe out, I prefer the old practice of cutting on the finger, which must be first introduced into the gut, then the fistula should be examined with a probe, and its direction and extent being ascertained, the probe is withdrawn, and a button-ended curved bistoury passed in its room, through the opening in the gut, if there be one, but if not, the bowel is to be rubbed between it and the finger till it make one; the end of the finger is then carried over the end of the knife, which being thus defended, the hand that holds the handle of the knife grasps the other, and the finger and knife are together drawn down, cutting through the *sphincter* as they are brought out. There are, however, two inconveniences as regards this operation, the Surgeon may cut his finger severely, or break the knife in the fistula, which I have seen when the patient has been unsteady.—J. F. S.]

932. In an internal blind fistula, the director should be carried to its bottom, pressed against the gorget, introduced into the *rectum*, and the partition divided with the straight bistoury, as in the former case.

933. After the completion of the operation and after the wound has been properly cleaned, the forefinger of the left hand should be introduced into the *rectum*, to the upper end of the wound, and then by means of a probe or pair of forceps well oiled, a tent of lint should be passed up and put lengthways between the edges of the wound, so as to prevent them touching; a wad of charpie is then to be put on, to be fixed with sticking plaster, then a compress, and the whole held together with a T

bandage. After the patient is put to bed in a convenient position upon his side, an opiate should be given, and the bandage is to be removed every time the bowels are relieved, (which should be every twenty-four hours,) after that the *rectum* has been cleared with lukewarm water; with the remark that in the following dressings the tent is no longer to be oiled, is to be thinner and thrust in less deeply as the wound is lessened by granulation. The scarring is promoted by the careful application of lunar caustic.

The opinion of **Pouteau** and others, that after the operation of cutting a rectal fistula any dressing is unnecessary and injurious, which of late has found advocates in von **Walther**, **Jaëger**, and others, I cannot accede to, inasmuch as experience has only shown that without dressing, the edges of the divided partition readily in part unite, and the fistulous passage does not close. That kind of dressing in which the wound is completely filled with several tents, and one thick tent is introduced into the *rectum*, as **Boyer**, **Sanson**, **Textor**, I myself, and others have recommended, I consider as unsuitable, and have given it up for the above-mentioned more simple treatment. A. **Cooper** (*a*) put after the operation a dry tent in the wound, and on the following morning applied a soothing poultice; in two or three days the tent comes out, and a probe should be frequently introduced into the wound for the purpose of preventing the adhesion. Poultices are to be continued, and when granulations spring up the tent must be again introduced, and by this treatment much pain and severe inflammation and suppuration are prevented.

934. The accidents which may occur during and after the operation by cutting are severe bleeding, too much or too little inflammation, copious suppuration, colic, *diarrhœa*, retention of urine, and costiveness.

A severe bleeding, if the bleeding vessel cannot be tied, or if the bleeding cannot be stopped by the application of styptics, requires plugging, in which a firm wad of lint bound crossways with two strong threads must be introduced into the *rectum*, up to the bleeding vessel, and between them, as they hang down from the gut, sufficient lint is to be introduced to fill the *rectum*, and then the threads are to be tied upon it. In females the *vagina* must also be plugged (1).

Severe inflammation requires besides loosening or removing the bandages, cold applications, leeches, soothing applications, clysters, oily mixtures, and the like; copious suppuration needs a corresponding strengthening treatment; spasmodic colic, oily mixtures with opium, soothing clysters and warm applications; for retention of urine, the use of the catheter, warm applications to the region of the bladder, soothing remedies and clysters, which are also equally indicated in costiveness (2).

[(1) Instances, though rare, have occurred of death from bleeding after the division of a rectal fistula, and I recollect seeing such a case very soon after I became a student, in which the patient died within twenty-four hours of the operation. **Copeland** objects very properly to the practice here advised of stuffing the *rectum* for the purpose of stopping the bleeding. "I have," says he, "so frequently seen the hæmorrhage kept up as long as this method of plugging the intestine was persevered in, and cease spontaneously when every kind of application was omitted, and the parts left for a short time exposed to the open air, together with a cool room, and avoiding all drink that hurries on the circulation, that I cannot help thinking that the irritation of the compresses keeps up the bleeding, and that the most eligible mode of treating it, when it is impossible to secure the vessel with a ligature, is to take off every kind of dressing, and to suffer the part, as much as possible, to be exposed to the external air. * * * I am persuaded, from repeated experience, that by being too busy with compresses, and styptics, and astringents, and such like applications, we most frequently only hide the bleeding and rather prolong its continuance, than otherwise. * * * After many unsuccessful attempts to secure a bleeding vessel under such circumstances, I once accomplished it by introducing a blunt gorget into the *rectum*; and by keeping the gut thus dilated, I was enabled to see the orifice of the bleeding artery and to secure it." (pp. 90–91.)

(*a*) Lectures on Surgery, vol. ii. p. 333.

(2) **Brodie** observes, that "in a very few cases *erysipelas* appears to extend up the mucous membrane of the *rectum* into the other parts of the intestine; and this is a most formidable disease indeed. The symptoms are very peculiar, and as far as I know, are not described by writers. The pulse becomes very rapid and at the same time weak; then it is irregular and intermitting; the *abdomen* is tympanitic in consequence of the intestines being distended with air; hiccough takes place; there is a great prostration of strength, and the patient often dies in the course of three or four days, sometimes sooner. * * * This internal erysipelas, however, is not necessarily fatal. I have known more than one case in which it manifestly occurred, but without the usual prostration of strength, and the patient recovered. When I have met with a case of this kind, I could never entertain a doubt as to the medical treatment which should be employed. It is sufficiently indicated by the symptoms; and for the most part, the great failure of the vital powers demands the free exhibition of cordials and stimulants." (p. 185–86.)]

935. The *ligature* of a rectal fistula (*Ligatura Fistulæ Ani*) consists in tying together the whole wall, separating the *rectum* from the fistula, with a thread which, by gradual tightening, cuts it through; in this case as the fistulous wall is divided, the part cut through, heals from above downwards. The proceeding in tying the rectal fistula varies according to its seat and condition. The best materials for the ligature are several hempen or silken threads put together, or a silken loop-shaped thread, and the silver or leaden thread recommended by many persons.

[**Luke**, of the London Hospital (*a*), during the course of the present year has advised the treatment of *fistula in ano*, by tying it with a thread, and says:—"The advantages of this method over that by the knife, are; *first*, the shorter period which usually elapses before the final cure; *second*, the less pain which is felt during the treatment; *third*, the absence of the dread which the knife generally inspires, and the consequent inducement which it offers to the patient to submit to effective curative treatment; and *lastly*, the avoidance of all hæmorrhage.

The *treatment* is to be conducted in the following manner:—an eyed-probe, armed with dentist's silk, is introduced through the fistula into the *rectum*, from whence the silk is withdrawn through the *anus*, by means of a catch-spring, introduced into the *rectum* upon the finger of the operator. The parts to be divided are then inclosed between the two extremities of the ligature, to which a small fistula-tourniquet is subsequently attached, by passing them through holes provided for the purpose. The requisite amount of tension is maintained by a screw. Care must be taken that the ligature be not so tight, as to cause more than slight uneasiness. After the lapse of two or three days, ulceration of the inclosed part commences and the tourniquet becomes loosened, indicating the necessity of the ligature being made tighter." (p. 221.)

Dr. **Nelken** (*b*) has proposed for this operation "an instrument composed, *first*, of a rod about eleven and a half inches in length, the upper third of which is divided into four equal parts, united to each other by hinges so arranged that they can be closed only in one direction, the last being furnished with a knot and a hole to pass the ligature, and *second*, of a tube, through which the former is passed when threaded. The finger being placed in the *rectum*, the apparatus thus prepared, is passed upwards into the fistula until the extremity reaches the finger, the tube is then withdrawn to an extent equal to one of the four divisions of the rod; the whole is next pushed forwards, the finger in the *rectum* causing the rod to bend downwards as it penetrates into the intestine; the same manœuvre is repeated until the ligature appears at the *anus*, when the Surgeon seizes it, and terminates the operation." (p. 403.)

Although **Luke** mentions nine cases in which he had in this way successfully tied anal fistula, I must confess I should not feel disposed to adopt it unless the patient would not submit to the knife, which I am quite sure produces a cure quite as quickly and with less inconvenience; for after the inflammation excited by the fresh cut subsides, there is scarcely any pain during the two or three weeks, usually necessary for healing the wound.—J. F. S.]

936. In complete rectal fistula, of which the internal opening is not very high, a flexible leaden probe should be introduced through the canal of the fistula into the *rectum*, which is then with the forefinger of the left hand already in the gut to be drawn out at the *anus* and a thread passed

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(*a*) Lancet, vol. i. 1845, New Series.

(*b*) Medical Times, vol. xi. 1845.

into its eye. In the same way, in complete fistula, silkworm gut may be introduced into the *rectum*, and by it the thread carried in.

937. For tying complete or inwardly blind fistulas which extend very high up, DESAULT, REISINGER, as well as WEIDMANN, SCHREGER, and DEMME have proposed particular apparatus, of which that of REISINGER is preferable. It consists of a blunt silver tube and a probe, providedwith a trocar point, which fits the tube, of a watch-spring, which in front has a button and behind an eye, and of a pair of forceps with a movable gorget.

938. In a complete rectal fistula, REISINGER'S apparatus is to be used in the following manner:—The patient being put in the same position as for cutting, the silver tube with its ensheathed probe is to be passed through the fistula into the *rectum* for about three lines' length, which is ascertained by the finger already there. The forceps having been oiled are then introduced into the *rectum* without the gorget, opened, and passed somewhat deeper in, that the tube may project between the arms of the forceps and be held fast by them. An assistant then removes the probe from the tube and passes in the watch-spring, which is provided with the ligature, through the tube into the *rectum*. As the watch-spring projects from the tube, it must be seized with the forceps, which, being closed, are drawn back, so that the watch-spring is drawn out of the *anus*, after it the ligature, and then the tube is to be removed.

In a fistula of the rectal sheath the tube must be brought through the sheath and the fistulous opening into the *rectum*, and then treated in exactly the same way. According to MOTT (*a*) a seton should be first introduced into this kind of fistula, and left there for some days; a thread is then to be drawn through the fistulous opening, and by means of an eyed needle the ends found in the sheath are to be drawn through the *perinæum* and the two ends tied together, as in rectal fistula.

939. In an inwardly blind fistula, the tube with its probe is to be carried by the fistulous canal to its very bottom, the blunt probe removed, and the trocar-pointed one introduced, without projecting it from the tube. The forceps, opened, are then passed with the gorget into the *rectum* about an inch above the tube, and both instruments inclined towards each other so that the tube becomes situated between the arms of the forceps. The assistant now thrusts the trocar-point out of the tube, by which the *rectum* is perforated and the trocar-point between the forceps' arms pressed against the gorget, so that the latter may recede from the forceps. The tube being then kept pressed against the gorget, an assistant draws out the trocar, and by means of the forefinger of the hand holding the forceps, the gorget is withdrawn, and removed from the forceps, which are then closed and the tube held by them. The watch-spring is then introduced through the tube, and proceeded with as already described.

940. The two ends of the thread introduced, are passed into the two openings of a small silver tube, and tied with a simple knot and loop, so tight that the patient may feel a degree of pressure but no pain. For the first day he must keep quiet, but afterwards may go about his usual business. Every three or four days the knot should be tightened as already directed; and care must be taken for the daily passage of soft motions. If much pain arise, the ligature must be tied more loosely, but in other respects the treatment is to be, as after the operation of cutting. The same mode of treatment is to be continued till the partition of the fistula is divided. In order to prevent the destruction of the ligature, at the

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(*a*) Gazette Médicale de Paris, 1841. No. 18.

end of the third or fourth week, if the cure be long protracted, a new ligature must be tied to the old one and drawn through. Usually, after the partition is cut through by the thread, there remains a little cleft, which still suppurates for some time, and heals by the application of some dry lint to the suppurating part.

941. As to the preference of *cutting* or *tying*, the latter mode is usually accompanied with little or no pain; the one indeed is longer, but the patient may go about his business, no bleeding is to be feared, and it may be employed when the fistula is very high. The operation on rectal fistula by ligature has, therefore, considerable preference and is especially indicated in cases, where the fistulous orifice is high up, where the hæmorrhoidal vessels are very large, and in persons who are subject to a habitual *diarrhœa*. Many Surgeons, indeed, dispute the necessity of dressing after cutting; but experience contradicts this opinion, and dressing is necessary throughout, if there be bleeding. On the contrary, in rectal fistula the preference is given to the operation by cutting, when the internal opening is not very high, when several neighbouring passages exist, a considerable exposure of the *rectum* is present and the external openings are distant from the *anus*.

Mention must be made of the propositions for compressing rectal fistulas by the introduction of tubes into the rectum (*a*), or by a cylinder of linen stuffed with charpie (*b*).

942. In the externally blind fistulas, if the bottom of the fistula can be ascertained by the appearances already mentioned, (*par.* 927,) it may be cut into externally, and then treated as complete fistula.

[SPASMODIC CONTRACTION OF THE ANUS, AND ANAL FISSURES.

This would seem to be the most convenient place to treat of this subject, which was first clearly described by Boyer (*c*), and afterwards by Dupuytren (*d*), and subsequently by Brodie (*e*).

Boyer does not consider the "rhagades ou fissures" mentioned by Lemonnier as the fissures of which he treats, as they neither originate in the same causes, nor are cured by the same treatment. According to Boyer, "Adults seem to be almost exclusively subject to this disease. I have never seen it," says he, "in children nor in young persons. The greater number of those attacked with it have been between twenty-five and forty years of age; some even above it, and a single person was sixty years old. No class of society is exempt from it; both sexes are alike liable to it; but females perhaps more frequently than men. The characteristic of fissure is a fixed pain at one spot of the circumference of the *anus*. This is always worse whilst passing the stools, but it gradually subsides afterwards. The *m. sphincter ani* is so contracted that the introduction of the finger, of a bougie, or canula is very difficult and extremely painful. The causes of this affection are very obscure. I have only observed that in many persons it has been preceded by hæmorrhoidal swelling, and that in some persons piles had been previously cut off. The disease commences insensibly; the voidance of the stools is attended with heat and smarting; some hours after the evacuation the troublesome pain ceases; the patient is believed to have piles or to have chafed. Sometimes after a few days these symptoms subside. * * * But soon the heat and smarting returns, the evacuations become more painful, and the distress continues longer. The dejections are sometimes mingled with blood, and the pain increases. * * * When the pain is felt the slightest things exasperate it; coughing, urining, leaping, are sometimes sufficient; one patient cannot stand upright and at rest, and another cannot remain sitting. * * * After

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(*a*) Bermont, Thèse, Paris, 1827, p. 33.—Colombe, Bibliothèque Médicale, 1828, vol. ii.

(*b*) Piedagnel, Velpeau, Dict. de Médecine, vol. iii. p. 328.

(*c*) De la Fissure ou Gercure de l'Anus, accompagnée du reserrement spasmodique du Sphincter; in his Traité des Maladies Chirurgicales, vol. x. Paris, 1825.

(*d*) De la Fissure à l'Anus; in Leçons Orales, vol. iii. 1831.

(*e*) Lectures on Diseases of the Rectum; in Med. Gazette, vol. xvi. 1835. vol. xviii. 1835.

the disease has continued some time, in addition to these local symptoms there is wasting, and extreme nervous sensibility, sometimes hypochondriasis, sometimes even retention of urine." (p. 126–30.)

"Although there is not the same danger in regard to *Fissures at the Anus*, as in some other diseases in the neighbourhood of this part, yet," says DUPUYTREN, "they are in general accompanied with such violent pains, that it is of importance to relieve them as soon as possible. The pains have a character in some degree peculiar; they increase gradually, and continue long after passing stool; sometimes lancinating; they are, however, most frequently burning; and patients abound in extreme terms to describe them. Usually they compare them to the sensation of a hot iron penetrating the *rectum;* they so dread passing their motions, on account of the horrible pain which accompanies and follows that function, that they are often observed to strive for a long time against this imperious need, and even to deprive themselves of food to restrain it. These peculiarities are sufficient to discover the nature of the disease. * * * The disease consists in a lengthy and superficial ulceration, about the margin of the *anus*, in the radiating folds of the mucous membrane of this part. On separating the orifice, and directing the patient to strain, a narrow cleft is observed, with its bottom red, and its edges slightly swollen and callous. But to ascertain its extent upwards, it is often necessary to introduce the finger into the *rectum.* It is more commonly seen at the sides or back of the *anus*, than at its fore part * * * It very rarely extends through the whole thickness of the mucous membrane. The importance of this affection depends principally on the painful spasm of the constrictors of the *anus.* The fissure is but accidental, as is proved by the existence of painful constriction, without any cracking, which, according to celebrated Surgeons, is as 1 to 4. This spasm is so great, that the introduction of the mildest bodies is intolerable; the tip of the finger, the pipe of a syringe, excites the most violent pains; and the resistance offered by the *anus* to every attempt at introduction, is a new characteristic sign of the affection. The causes of anal fissures are numerous; constipation, and the spasm it produces, specially dispose to the disease; very hard substances which scrape the mucous membrane, and distend it exceedingly, may give rise to it; the administration of clysters by awkward persons, especially when metallic tubes, pointed or rough are used, are often the immediate cause; they are met with in persons affected with hæmorrhoids, and venereal poison flowing from the generative organs, which happens with many women, is a very common cause of this affection." (p. 282–85.)

BRODIE (*a*) says that "the contraction of the *sphincter* at first appears to be merely spasmodic, without any other change of its condition; but in proportion as muscles are called into greater action, so they become increased in bulk; and in conformity with this general rule, when spasmodic contraction of the *sphincter* muscle has existed for a long time, the muscle becomes considerably larger than it was in its natural state before the disease existed. This disease is not of uncommon occurrence; it is met with chiefly in women, especially those disposed to *hysteria.* It is, however, met with in other women, and sometimes in the male sex. The patient under these circumstances is forced to strain very much in passing her evacuations; and this is especially the case when the *fæces* are hard, or even solid. There is pain not only when the *fæces* are being passed, but for a very considerable length of time afterwards; and in some cases the pain will remain from the period of one alvine evacuation to that of another, so that it is constant, or nearly so." (p. 26.)

The fissures present various differences according to their situation, "those *below* the *m. sphincter ani*, affecting almost entirely the cutaneous tissue, and not the anal mucous surface, produce," says DUPUYTREN, "a more or less severe *pruritus*, but they interfere little with going to stool, occasion no constriction of the *sphincter*, and consequently are little painful. They most commonly result from venereal affection. The fissures *above* the *sphincter*, attack the mucous membrane, and can only be discovered by the use of the *speculum.* On introducing the finger into the *rectum*, there is felt at the part where they are situated, a cord knotty and hard, pressure upon which excites severe pain. They excite, when the patient goes to stool, an indescribable pain, but which ceases immediately after the motion. The *fæces* are covered with puriform mucous, and of a bloody appearance next the fissure. Usually they result from ulceration of internal piles, during the passage of hardened substances. Finally the fissures *at the top* of the *sphincter* are more serious than the former; and it is in them that the so painful constriction of the *sphincter*, and the other symptoms already mentioned, are observed." (p. 284.) It is doubtless to this form that BRODIE refers, when he says, "in connexion with the spasmodic contraction of the *sphincter* muscle, you will frequently

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(*a*) Lectures on Diseases of the Rectum; in Med. Gazette, vol. xvi.

find a small ulcer of the mucous membrane of the *rectum*, which is always in a particular spot at the posterior part, opposite to the point of the *os coccygis*. (p. 26.) But he also observes, that "in some instances the ulcer exists independently of the contracted *sphincter* muscle. * * * It is very difficult to heal, and very frequently it goes on spreading till it becomes of considerable size. It is a superficial ulcer of exquisite sensibility, and great pain is always produced by the passage of the *fæces* over it, lasting for a considerable time after each evacuation. In some instances, considerable hæmorrhage takes place from an ulcer of this kind." (p. 27.)

Treatment:—"The spasmodic construction," says Dupuytren, "is the true ailment; the lengthy ulceration, named fissure or crack, is merely a secondary symptom. If the constriction be removed, the complaint is cured. The application of *belladonna* under these circumstances is naturally indicated, and has been used very frequently with great advantage, when combined with acetate of lead in the following form: of lard 6 gros, of extract of *belladonna* and acetate of lead, of each one gros. With this a bougie of moderate size is to be greased, and its size gradually increased to that of the little finger. Its continued use for a few days often completely removes the pain." (p. 286.) Brodie, however observes, that though he "formerly used a suppository with extract of *belladonna* with manifest advantage, yet that he is not in the habit of frequently employing it. Even used in the form of a suppository, the *belladonna* sometimes produces very serious symptoms, by its influence on the brain." (p. 26.) He, therefore, only gives purgative medicine to prevent hard stools, directs the introduction of a bougie before going to the water-closet, and lets an opium suppository be introduced at night.

"The fissures below and above the *sphincter* most commonly heal," according to Dupuytren, "without any operation; the former, with linen or lint spread with simple cerate, opiate cerate, cucumber pommade, poplar ointment, mercurial preparations, &c., and the latter, by soothing and narcotic lotions of decoction of marsh-mallow, poppy heads, nightshade, henbane, *stramonium*, and other remedies, thrown up into the *rectum*. * * * But in very painful fissures accompanied with spasmodic contraction of the *anus*, and situated at the very top of the *sphincter* muscle, the most prompt and certain method is that introduced by Professor Boyer, which requires only a common and a button-ended bistoury," (p. 290,) and which is thus described:—"I place the patient," says Boyer, "upon his side, as in the operation for anal fistula; I then introduce the fore-finger of my left hand, smeared with cerate, into the *rectum*, and upon it slip up a bistoury laid flat, of which the very narrow blade is square, and with a rounded tip. The cutting edge is directed right or left, according to the situation of the fissure, and I divide, at a single stroke, the intestinal membrane, the *sphincter*, cellular tissue, and tegument. I thus form a triangular wound, of which the top corresponds to the gut and the bottom to the skin; it is sometimes necessary to lengthen the wound, and I then make a second cut. Sometimes the intestine slips from the cutting instrument, and the wound of the cellular tissue extends higher than that in the gut; the bistoury must then be again introduced into the *rectum*, for the purpose of lengthening the incision of the gut. If the constriction be very great, I make two cuts, one on the right and the other on the left, and when the fissure is before or behind, I do not include it in the wound. A large bougie is then to be introduced into the wound or into the two wounds, to prevent their edges uniting irregularly. A slight plugging with lint is then made, some pads applied, and the whole supported by a bandage." (p. 137.) A very important caution, in reference to operating on women, is given by Brodie. "In a female subject, whether you divide the *sphincter* in a case of fistula, or in one of any other disease, I caution you. that you should never make your incision exactly in front, towards the *vagina*. The wound made in this direction does not heal in a proper manner; the muscle, if divided at this point, is never a perfect *sphincter* afterwards, and the patient labours under an incontinence of *fæces*, from which she never completely recovers, and which makes her miserable for life. Then, it is not advisable, in either sex, that you should divide the *sphincter* directly backwards towards the *os coccygis*. If you do, you will find that the wound does not very readily close, and that it is liable to crack and be reopened afterwards. There is a sufficient anatomical explanation of what I have now mentioned. You will recollect that the *sphincter ani* consists of two parts or layers. The inner layer is circular, embracing the *anus* like a ring; the external layer on each side is attached posteriorly to the apex of the *os coccygis*, by elastic ligament, and anteriorly to the central portion of the *perinæum*. If you cut in the direction backwards towards the *os coccygis*, you divide, it is true, the inner or circular layer of fibres, but not of the outer layer. The knife passes between the two lateral portions of this outward layer and simply splits or separates them; and the contractive power of this part of the muscle remains and interferes with the cicatrization of the wound." (p. 186.) "The operation of dividing the *sphincter*," he elsewhere observes (*a*), "is not very painful, except in those cases where the disease is complicated with ulcer at the back of the *rectum*; neither is there ever any hæmorrhage of consequence, as the pressure of the finger or a plug of lint will command it. The relief is immediate, and the very next time that the patient has an evacuation, there is an end of all the pain and difficulty which she suffered before. It is better, however, that she should not have an evacuation immediately after the operation, and, therefore, I generally give her an active purgative on the preceding day, and some opium afterwards, to keep the bowels constipated. After two or three days, castor oil may be exhibited and the bowels opened. The wound requires very simple treatment; a little dressing of lint may be applied to it till it is cicatrized, and cicatrization is generally completed in about three weeks. No inconvenience whatever follows the division of the *sphincter* muscle, except it be made, as I have mentioned, in the female, in the direction forwards. The patient retains her *fæces* as well as ever, and yet the difficulty of voiding them is relieved." (p. 27.)]

E.—OF URINARY FISTULA.

(*Fistula Urinaria*, Lat.; *Urinfistel*, Germ.; *Fistule Urinaire*, Fr.)

Desault, Œuvres Chirurgicales, vol. iii. p. 287.

Howship, A Practical Treatise on the symptoms, causes, &c. of the most important Complaints that affect the secretion and excretion of the Urine. London, 1823. 8vo.

Chopart, Traité des Maladies des Voies Urinaires. Nouv. Edit. par **Felix Pascal**, Paris, 1824, vol. ii. p. 269.

Bell, Charles, above cited.

Brodie, Sir Benjamin, Clinical Lecture on Perinæal Fistula; in Medical Gazette, vol. xvii. 1836.

943. Under the term *Urinary Fistulas*, strictly, are understood, long and narrow ulcers opening in any part of the urinary passages; fistulous sores, however, in their neighbourhood are included under the same head. Urinary, like rectal, fistulas are therefore distinguished into *complete* and *incomplete*, according as they have an internal aperture communicating with the urinary passage, and an external opening, or the latter only. The incomplete urinary fistulas are either *incomplete internal*, or *incomplete external*.

944. The external opening of urinary fistula may be situated either in the *perinæum*, *scrotum*, *penis*, buttocks, thighs, loins, belly, in the *vagina* or in the *rectum*; as the internal opening may be connected with the kidney, ureter, bladder, or *urethra*. The direction of fistulous passage is mostly curved, several passages often run into one and the same opening; but rarely do several external apertures lead to as many internal. Usually the walls of the fistulous passages are very hard and the callosities wide-spread.

945. The *incomplete external* or *false urinary fistula* (*Fistula urinaria incompleta externa, seu spuria*) occurs mostly in the neighbourhood of the *urethra*, after abscess or ulcer, in which pus has collected and burrowing in different directions, has destroyed the cellular tissue surrounding the *urethra* or bladder, and produced a sinuous ulcer which resists the healing powers of nature. They may be connected with hardening, with *caries* of the pelvic bones, and the like. Besides the preceding appearances, they are characterized by no urine escaping from them nor any pus from the *urethra*, and by the probe used in examining them penetrating neither into the *urethra* nor bladder, nor touching a catheter introduced into the latter.

946. The *incomplete internal urinary fistula* (*Fistula urinaria incom-*

(*a*) Med. Gazette, vol. xvi.

pleta interna) usually occurs in the *urethra*, rarely in the ureters or bladder, and depends on tearing by external violence, retention of urine, neighbouring abscesses, ulcers, rough catheterism, or an imprisoned stone. The *diagnosis* depends on the previous symptoms, on the sensation of pain during or after passing water, on the bloody purulent discharge from the *urethra*, but especially on a swelling, which increases during micturition, diminishes or disappears entirely by pressure, in consequence of which urine mixed with pus, flows from the *urethra*, or on the appearance of an undefined extravasation of urine into the cellular tissue.

In persons who have lost flesh by sweating or in any other way, there often occurs, without any previous contagion, a flow of *mucus* from the *urethra*, and a swelling at some part of its neighbourhood, which runs into suppuration, bursts, and gives escape to the urine, in which the flow of *mucus* from the bladder continues, but without any stricture existing. The destruction of the *urethra* depends on ulceration of the mucous membrane or abscesses in the *lacunæ* (*a*).

[This incomplete fistula I have seen though not very frequently, and have more commonly observed it in front of the *perinæum*, and involved in the *scrotum*, sometimes at its hind and at other times in its front part. It has been exceedingly well described by Brodie in the following terms:—"I shall next describe a case which used to perplex me very much when I first met with it. A patient may come to you who has, perhaps, had *gonorrhœa* formerly, which has been followed by a stricture, perhaps a very slight one, of the *urethra*, or at any rate there has been a discharge from the *urethra*, which he calls an obstinate gleet, telling you at the same time that nothing will cure it. You examine the *perinæum*, and you find in it a little tumour, not bigger apparently than a horse-bean or filbert. You can just feel it, at some distance below the skin, and the patient tells you that he has had it ever since he has been the subject of this obstinate gleet, and that sometimes there is a little pain in it. Now such a little hard tumour is nothing more nor less than a blind fistula. There is a small orifice in the *urethra*, and a narrow channel communicating with it, which leads into a cavity in the centre of this hard lump, and every time the patient makes water a very small portion of urine finds its way into this cavity. In consequence of the smallness of the central cavity and the great deposit of solid matter on its outside, the fluctuation of fluid in it is not perceptible. Such a case as this is not a very uncommon occurrence, and I have known a patient labour under this sort of hard lump in the *perinæum* for many successive years, suffering a good deal of inconvenience from it, but not suffering excessively. I have cured several cases of this kind by a very simple process. All that you have to do is to make an opening into the cavity in the centre of the tumour. But the cavity is very small and how are you to find it? You may run a lancet into it; but it is very probable that it may pass on one side of the cavity, and therefore some management is necessary in performing the operation. You are to introduce the lancet a little obliquely, so that you may, as it were, almost cut the tumour in half. When you have done this the blood and the deep-seated situation of the tumour prevent you seeing whether you have made the opening into the central cavity or not. Introduce a piece of lint, so as to prevent the wound uniting by the first intention. Two or three days afterwards you take out the lint, and then you ascertain whether, when the patient makes water, any comes by the opening made with the lancet. If this be the case you may be certain that you have penetrated into the cavity, and then you have only to dilate the *urethra* with a proper instrument and the patient will get well. But if you find that the urine does not flow through the artificial opening, you may thus proceed:—Introduce a piece of caustic potash through the opening you have made down to the bottom of it, in the centre of the tumour, so as to make a slough there. A portion of the tumour will slough out, and it is most probable that the cavity in the centre will be exposed, and then a cure follows. You should apply the caustic potash in such a manner that it may act on the part on which you wish to act, defending at the same time the neighbouring textures, the skin especially, by washing it with vinegar." (p. 489.)]

947. *Complete urinary Fistula* (*Fistula urinaria completa*) is the most common. Its internal opening arises either from the kidneys, ureters, bladder or *urethra*, and its external aperture, often very far distant from the internal, is found in the loins, in the groin, above the share-bone, in

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(*a*) Cooper, Astley.

the *perinæum*, and so on; or it communicates with the *rectum*, with the *colon*, with the *vagina* in women, or with the cavity of the belly, in which case there is always a fatal effusion of urine into it. Complete urinary fistulas are mostly consequent on retention of urine, tearing, injury of the bladder, or an incomplete internal or external fistula. These, which in men open into the *rectum*, frequently occur after the operation for the stone, as those connected with the *vagina* take place after difficult delivery, or after ulceration of the *vagina*. Cancer of the *rectum* and of the *vagina* may also produce urinary fistula.

Complete urinary fistula is characterized by the escape of urine, which is constant, if the fistula be from the bladder, but only whilst making water, if from the *urethra;* this escape, however, is not always present in complete fistula, as if the fistulous passage be very narrow, and the *urethra* not obstructed, the urine often passes by the latter alone, and in fistula of the bladder, if the canal be very narrow and curved, often only by straining, whilst emptying the bladder. It also depends on the condition of the fistulous canal, whether the probe introduced into it can be made to touch a catheter in the *urethra* or bladder. If the fistula communicate with the *vagina* or *rectum*, the urine escapes by these canals; or the opening of the fistula is felt by the finger introduced into it, or merely by the sound passed into the bladder. If the fistula be connected with the *rectum* the urine flows through it or is mixed with stool. Less constant are these symptoms, viz., hardening of the course of the fistulous canal, or in the whole extent of the *perinæum*, inflammation, unhealthy suppuration, proud flesh about the fistulous opening, loss of power, wasting, hectic fever, and the like.

948. The *prognosis* in urinary fistula depends on its situation and extent, on the constitution of the patient, and on other diseases connected with it. Complete fistulas, of which the internal opening is connected with little loss of substance, heal more easily than those which have it with greater loss of substance; fistulas of the *urethra*, under similar circumstances, heal more readily than those of the bladder. When the canal of the *urethra* is considerably changed, greatly narrowed, or entirely obstructed, and cannot be reopened, the cure is impossible. Urinary fistulas communicating with the *vagina* or *rectum* are extremely difficult, and frequently not to be healed. A bad state of the patient's powers renders the *prognosis* very doubtful.

949. The *cure* of incomplete external fistula requires the general treatment of fistulous sores. Suitable pressure often assists the healing; often must the fistulous orifice be enlarged by a conical cut, of which the point is directed towards the *urethra* or the bladder, the source of the pus laid bare, every neighbouring passage opened, and care taken for the free flow of the pus. If there be callosities, dispersing bran poultices and proper digestive remedies must be employed. If *caries* be connected with this fistula or any general affection be connected with it, the treatment must be modified according to general rules.

950. Incomplete internal urinary fistula requires the introduction of a catheter, which often, if the *urethra* be narrow, must be preceded by the use of the bougie. The catheter must be of moderate size; otherwise it fills up the *urethra* too much, or the urine escapes by its side. If the fistula be old and the cure do not in this way take place, the incomplete must be changed into a complete fistula by a suitable cut, which is also necessary in extensive urinary infiltration, where several incisions often must be made,

in order to prevent the gangrenous destruction caused by the escape of the urine.

Stones frequently lie in the sac of a blind fistula, in which case cutting into it and the the removal of the stone is necessary, and afterwards the treatment is to be as in complete fistula. Compare also what is hereafter said about urinary stones exterior to the urinary passages.

951. Complete urinary fistulas communicating with the kidneys, or ureters, require no assistance, unless kept up by the pressure of a foreign body or by prevention of the flow of urine from the bladder, in which case perhaps the restoration of the natural area of the *urethra*, or the removal of the foreign body, may contribute to the cure.

952. Complete urinary fistula is situated either between the *scrotum* and the *glans penis*, or between it and the *anus* in the *perinæum*. The difference of the seat of the fistula depends on its course, and requires different treatment.

953. In the first case, (*Fistula urinaria penis*,) the fistulous opening is most commonly on the under side of the *penis*, varying in size, so that either all the urine and *semen*, or only part of it, escapes thereby. It presents different conditions, according to its cause and duration; it is often connected with surrounding hardness and copious suppuration, especially if it arise from stricture; often it forms an extremely minute and obliquely running aperture; often the skin and the neighbouring mucous membrane of the *urethra*, skin over, and do not suppurate; often is a large portion of the lower wall of the *urethra* destroyed, and the opening varying in size, surrounded with a hard scar, as in destroying ulcers or wounds with loss of substance. In narrow and obliquely running fistulas, the introduction of a probe, through the fistula, and of a catheter through the *urethra*, shows the seat of the internal opening.

954. If the fistula be accompanied with narrowing of the *urethra*, this must be first got rid of by bougies, and then by the continual wearing an elastic catheter, which should be properly fastened, the urine must be conveyed from the fistula. At the same time, any disease, standing in causal relation to the fistula must be attended to, and care taken for the cleanliness and diminution of the irritated condition of the parts surrounding the fistula, by warm hip-baths, leeches, poultices, and so on; and the patient's constitutional powers must be improved by attention to diet and tonic remedies. The cure usually takes place without further assistance, if the fistulous orifice be not too large, and its walls not too much changed.

955. If, when the *urethra* have attained its proper size, the cure of the fistula do not take place, or if there be scarcely any diminution in the size of the stream of urine, the cause of the obstinacy of the fistula is its callous or some other condition. Then, if the fistula form a canal, it must be divided and filled with lint to promote the development of granulations; or the edges of the fistula, especially if they be callous, must be touched with caustics, as lunar caustic, nitric acid, (A. Cooper,) a solution of caustic potash, or with *tinct. canth.*, (Dieffenbach,) because this is less destructive than irritative. In the application of the caustics, a moderately thick bougie should be introduced into the *urethra*, the cauterization repeated after the separation of the slough till good granulations are produced, the scarring of which may be assisted with lunar caustic. After the narrow or oblique fistula has been dilated, Dieffenbach recommends the cauteri-

zation of the whole fistulous canal, by means of a pencil, three times within six or eight hours, a wax bougie being in the *urethra*, after which an elastic catheter is to be introduced and fastened; next morning the slough is to be removed by introducing a fine piece of sponge into the fistula, and the cauterization repeated after suppuration has been set up, till good granulations are developed. The catheter should always be changed twice a day. In two or three months the cure of a tolerably large fistula may be effected, rarely however is the healing thus produced, and although the external opening be closed, it may be again burst open by a large stream of urine or during connexion (DIEFFENBACH.)

If the cauterization of such fistulas do well, it may not merely be confined to the callous edges, but may be extended to the immediate neighbourhood, as ROSER especially has done, and my own practice has assured me.

956. For closing these urethral fistulas, the suture of various kind, has been used, the interrupted stitch, (A. COOPER, DIEFFENBACH and others,) the glover's stitch, (ZANG,) the twisted stitch with five insect-pins, (DIEFFENBACH and others,) the quill stitch, (FRIEMANN,) and the splint stitch, (DIEFFENBACH,) which resembles it. The result has been, however, rarely satisfactory, because the thin edges of the skin afford insufficient points of union, and are little disposed to adhesion, which is also easily destroyed by the trickling urine, in spite of the catheter which has been introduced. The patient should be placed, as in the operation of cutting for the stone, and after a catheter has been introduced, the edges of the wound should be made raw, in small fistulas with caustic, or by shaving off the skin with a thin knife, and in larger openings a thin slice must be removed. According to the different size of the fistulas are a sufficient number of threads to be introduced with a fine needle, or sufficient insect-pins to be passed into the bottom of the fistula, and the union effected by tying together the threads, or twisting the silk around the pins. If much tension of the skin arise in consequence, a longitudinal cut must be made into the skin, half an inch from the wound and stretching beyond it, in order to relieve the tension, and to prevent the pins tearing out.

957. In fistulas not of large size, if surrounded with healthy skin and not immediately behind the *glans*, DIEFFENBACH has proposed and proved the running stitch as the most efficient. A catheter is to be introduced and the fistula frequently pencilled with *tinct. canthar.* On alternate days the blisters which have been produced are to be removed, and a short tolerably thick elastic bougie introduced into the *urethra*. A thick, double-waxed silken thread is now to be passed, with a curved needle, a quarter of an inch from the edge of the fistula, so that the threads may lie deep, without injuring the *urethra*. As the needle cannot be at once thrust through the whole extent, it must be thrice passed through, and introduced again through the same punctures, till in the end it comes out through the first puncture and the threads are drawn after it. Both ends of the thread are now to be tied with the double knot, so that the threads lie deep in the cellular tissue. The bougie is then removed, and no catheter introduced. A slight swelling of the *penis* occurs; towards the seventh day, the threads become loose and can be somewhat drawn out; they may then be cut through and the part covered with sticking plaster. If a slight fistulous orifice remain, it may be touched with *tinct. lyttæ*, or the operation repeated.

958. In those fistulas which have much loss of substance, various experiments have been made to close them by grafting skin (*Urethroplasty.*) A. **Cooper**, **Earle**, **Alliot**, **Delpech**, **Ricord** have formed the covering flaps from the skin of the *scrotum* and groin twisted round; but **Cooper** and **Alliot** alone have obtained any satisfactory result. The ground of this frequent disappointment is easily perceived, and **Dieffenbach** has proposed for such cases a corresponding operation by transplanting by means of removing the skin.

959. In fistula near the *scrotum*, after the catheter has been introduced into the bladder, the edges of the fistula are to be seized with a pair of hook forceps, and so drawn out that a transverse wound with two sharp points stretching on each side of the *penis* is formed. A longitudinal fold of the skin of the *scrotum* is to be then raised and cut through to the extent of two inches, so that a transverse wound, parallel to the former, is produced, and the bridge of skin which has been formed by it is detached from its base by cutting horizontally, then drawn forwards and fastened with five or six twisted stitches to the edge of the skin of the *penis*. Beneath the hinder edge of this bridge of skin, an elastic bougie two inches long is to be introduced to the aperture in the *urethra*, in order to divert the urine pressing out by the side of the catheter. After some days the threads are to be removed, and the union to be sustained with sticking plaster.

960. In large fistulas in the middle or fore part of the *penis*, the transplanting of the skin may be effected in various ways. In great deficiency of the *urethra* in the middle of the *penis*, with destruction of the skin, so that the edges of the latter cannot be drawn over the opening by lateral incision and setting free the bridge, the edges of the skin about the aperture must be set free, without separation, so far as may be easily done, then a longitudinal incision must be made on each side of the root of the *penis*, so that the wound occupies two-thirds of the extent of the *penis*. The outer skin of the prepuce is then to be drawn somewhat back, the skin of the first incision raised on the opposite side of the *penis*, behind the *corona glandis*, in a large longitudinal fold, and here also two-thirds of the skin of the *penis* cut through. The covering of the *penis* included between the two incisions and usually forming a bridge of skin two inches broad, is now to be separated, the edge raised with a pair of forceps, and the cellular tissue divided with a pair of sharp eye-scissors. The skin is now to be drawn completely down, so that the sound skin of the back of the *penis* descends and completely covers the hole in the *urethra*. Any tension of the skin is relieved by lengthening the incision. To prevent the collection of blood between the skin and the *penis*, the bleeding must be carefully stanched, and then the retraction of the skin to its old situation prevented, and its union promoted by some stitches and by some narrow strips of well sticking adhesive plaster. From the hinder edge of the wound, on the under side of the *penis*, a piece of elastic bougie is pushed beneath the skin, towards the hole in the *urethra*, in order to conduct externally the urine dribbling by the catheter. Erections must be especially prevented, and on their occurrence the strips of plaster must be cut through. After four or five days, if the skin be grown together, the threads may be cut, but the application of the sticking plaster must be continued. The bougie is only to be left off after the most complete healing.

961. According to **Dieffenbach**, if there be a hole close behind the prepuce, the external layer of the prepuce should be transplanted backwards as an entire ring, the outer layer of the prepuce being raised up before the fistula and cut through, so that the wound may occupy more than two-thirds of the circumference of the *penis*. Behind the fistula a corresponding incision is formed by the oblique division of a longitudinal fold, so that the two cuts join at their extremities, and thus an oval island is formed, having in the middle the fistula which has been prepared by some strokes of the knife laid flat. The edge of the wound in the prepuce is now raised with a pair of hook forceps, the cellular tissue connecting the outer and inner folds of the prepuce, divided with eye-scissors, the *frænulum* cut through, as well as the outer fold of the prepuce, where connected with the *glans*, and thus an opening is formed of half an inch for the introduction of a small bougie, for the escape of the secretion of the wound and the prevention of urinary effusion. The hinder edge of the outer layer of the prepuce is to be drawn back and united to the corresponding wounded edge of the skin of the *penis* by seven or eight stitches and the connexion supported by narrow strips of plaster crossing in the back of the *penis*. In very narrow prepuce both its layers must be divided to the *corona*.

962. In large openings immediately behind the *glans*, if the prepuce be deficient, **Dieffenbach** recommends the removal of the callous edges, so as to form a transverse cleft, and then by depressing the *glans* the edges of the wound are brought together and united by two interrupted stitches, the one end of which is to be cut off and the other carried by a blunt needle through the fistula to the mouth of the *urethra*. The neighbourhood of the fistula and the whole under surface of the *glans* is then to be set free, to the extent of a line with a pair of hook forceps and a small scalpel. The extent of the cut must be bounded by penetrating perpendicular incisions, and the wound have the shape of a half oval, of which the rounded part is to be directed towards the orifice of the *urethra*, its straight part backwards and its two angles reaching up to the back of the *penis*. The skin is now raised in a longitudinal fold, at the hinder and under part of the *penis*, and cut through obliquely, so that the ends of the cut are directed upwards and forwards. This bridge of skin, so entirely separated that it remains connected only on the back of the *penis*, is drawn forwards over the surface of the wound and over the fistula, and connected with the edges of the wound of the *glans* by fine interrupted stitches. The hinder surface of the wound is covered with soft lint and sticking plaster, and beneath the hind edge of the ring of skin, a piece of bougie is introduced in order to carry off the urine somewhat escaping by the side of the catheter. Inflammation is to be prevented by cold applications and subsequently lukewarm lead wash, and the threads projecting from the *urethra*, as well as the catheter, are to be drawn out when they have cut through the edges. In one case **Dieffenbach** had a favourable result; in another the cure was frustrated by erection and discharge of the *semen*.

Upon Urethroplasty compare—

Cooper, A., above cited.

Delpech, Chirurgie Clinique de Montpellier, vol. ii. p. 581.

Blandin, Autoplastic, p. 180.

Dieffenbach, Ueber die Heilung widernatürlichen Oeffnungen in den oorderen Theile der männlichen Harnrohre; in Hamburger Zeitschrift, vol. ii. pt. i.

Zeis, Handbuch der plastischen Chirurgie, p. 506.

In one case in which, by a deeply-eating ulcer, the *urethra* was completely destroyed to a considerable extent, CHARLES BELL undertook the formation of a new passage for the urine. A hollow sound was introduced through the fistulous opening, and through the orifice of the *urethra* a silver tube six inches in length, into which a metal sound and a pointed stilette could be passed, was passed by the *urethra* to the beginning of the fistula. He then thrust the stilette through the body of the *penis*, near the original canal of the *urethra*, and endeavoured to bring its point on one side of the fistula into the groove of the hollow sound, following the proper canal of the *urethra*. This canal was then rendered callous by continuing the tube in it. During the course of this operation no blood was lost, the symptoms were not severe, but there remained a small lateral opening at the previous seat of the fistula (*a*).

963. Complete urinary fistula in the hinder part of the *urethra*, of which the inner opening corresponds to the *bulb*, the *membranous* or *prostatic* part of the *urethra*, (*Fistula urethro-perinæalis*,) arises either from a previous incomplete fistula, (*par.* 946,) or after infiltration of urine, most commonly depending on stricture, bruising, tearing, or wound of the *urethra*, or stone, severe inflammation and ulceration. The external opening is either in the *perinæum*, in the neighbourhood of the *rectum*, on the *penis*, or in the groin; often there are several openings existing at once on these several places, which, however, are connected only with *one* internal opening. These fistulas are generally accompanied with considerable hardening of their neighbourhood, with hardness of the whole *perinæum*, and even of the *scrotum*. The urine, whilst being passed, escapes through them only in part, or it flows entirely through the fistula; in which case, if long continued, the fore part of the *urethra* contracts and shrivels up. If in old strictures there be a paralytic condition of the neck of the bladder, the urine will constantly and unwittingly flow by the fistula. In consequence of the continued irritability of the fistula, and its neighbourhood, of the suppuration and so on, the general health gradually suffers much, the patient wastes, the digestion becomes bad, and on the least occasion, severe though generally slight consecutive fever ensues.

[BRODIE observes, that "*a fistula in perinæo* occurs in some cases, as a consequence of *gonorrhœa*; in other cases as the consequence of stricture, either independently of *gonorrhœa*, or long after it has subsided. These two kinds of *fistulæ in perinæo* require each a separate notice. A man has a severe *gonorrhœa*; the urine comes away in a very small stream, because the *urethra* is inflamed, swollen, and contracted. At last he complains of pain in the *perinæum*; a tumour is found there, and this state of things is frequently attended with a complete retention of urine in the bladder; at other times, however, it is attended only with an increased difficulty of making water. By-and-by the tumour bursts, or perhaps the Surgeon feels fluctuation in it, and opens it with a lancet, pus is discharged, then the difficulty of making water subsides, and a day or two afterwards the patient finds that whenever he voids his urine, a portion of it comes by the opening in the *perinæum*. In another case, the patient has, perhaps, never had *gonorrhœa*; or if he has had one, it has subsided and left a contraction or stricture of the *urethra*. On some occasion he has more than usual difficulty in making water, but not amounting to a complete retention of urine. Under these circumstances, he discovers a swelling in the *perinæum*, which increases in size, and becomes painful and tender. The tumour bursts, or the Surgeon opens it; matter escapes also in this case, and afterwards a portion of the urine comes away through the opening Where this disease is connected with *gonorrhœa*, there is generally only a single abscess; but when it is connected with a stricture of the *urethra*, there may be many abscesses formed in succession; so that a patient having a stricture of the *urethra* of long standing, may have *fistulæ* formed in various directions, opening into the *perinæum*, in the middle of the *scrotum*, nay, even in the groin, or on the *nates*, or one of them may, perhaps, open into the *rectum*." (p. 486.)

As regards the immediate cause of these kinds of perinæal abscess, as "in many cases the contents of the abscess bear manifest indications of urine having been mixed

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(*a*) System der operativen Chirurgie, vol. i. p. 102.

with them, and that in all cases, in the course of two or three days after the abscess has burst, urine begins to flow through it; I think you will be inclined to believe with me, that an aperture must have formed by ulceration in the mucous membrane of the *urethra* in the first instance. Such ulceration would allow a little urine to dribble in to the cellular membrane, and the formation of an abscess would be the necessary consequence. This is the simplest way of explaining the formation of these *fistulæ*, and it explains everything about them. The escape of even a single drop of urine into the cellular membrane would be sufficient to do all this mischief." (p. 487.)]

964. As these urethral fistulas are for the most part connected with narrowing of the *urethra*, the first indication consists in the proper widening of this canal, with wax or elastic bougies, to its proper size. For the due carrying off the urine from the fistula, the introduction of the elastic catheter occasionally, through which the urine may pass, is necessary. If in this treatment, any disease having causal relations to the fistula be attended to, if care be taken for cleanliness and the diminution of the irritation of the parts surrounding the fistula, by poultices, warm hip-baths, leeches, and the like, the patient's condition is improved; if any foreign body in the fistula be removed, it generally heals without further assistance.

Opinions vary as regards the introduction of a catheter, in the cure of urethral fistulas. The objections made by Hunter, B. Bell (*a*), Richter (*b*), and others (*c*), to the introduction of the catheter in the cure of urethral fistulas are, that the catheter, if suitable for its purpose, must completely fill the *urethra*, by which the edges of the fistula are separated, and the cure prevented; if the catheter be too small, the urine escapes by its side and comes in contact with the fistula. The continuance of the catheter in the *urethra* is extremely painful to many patients, and does harm by keeping up the irritation; experience also shows that fistula of the *urethra*, when the latter has attained its natural size, heals without the in-lying of the catheter. As, however, experience declares as well for the contrary, so if the internal fistulous opening be a small one, the introduction of the catheter be very painful for the patient, and therefore it is impossible that the whole canal of the *urethra* can be filled by it and the urine completely withdrawn from the fistula, the introduction of the catheter must be given up. On the other hand, under opposite circumstances, and if it be observed that the cure of the internal fistulous orifice give rise to a narrowing of the *urethra*, the introduction of an elastic catheter may and should be attempted. Only in fistula arising from ulceration of the *urethra* without stricture, (*par.* 946,) is the use of the bougie and catheter doubtful, as they only increase the disposition to ulceration, and the local as well as the general irritation. Corresponding remedies must be employed internally to the constitutional powers.

[As the cause of the continuance of perinæal fistula is the dribbling of the urine through it in consequence of the contraction of the *urethra*, in front of the aperture by which it escapes by that canal, "to cure the fistula, you must," as Brodie observes, "remove the contraction, restoring the *urethra* to its natural diameter. In a case of fistula after *gonorrhœa*, this is easily accomplished. A few introductions of a bougie will probably be sufficient to dilate the *urethra*, and make the fistula heal. In cases of *fistula in perinæo*, connected with chronic stricture of the *urethra*, the treatment is just the same. All you have to do, is to cure the stricture, and in nineteen cases out of twenty, by the time that is fully dilated, the fistula is healed. It is more easy for the urine to pass along the natural passage, if it be of its proper diameter, than it is for it to pass through the oblique passage of the fistula. The fistula has generally a kind of valvular opening in the *urethra*, into which the urine does not easily flow; and when you have dilated the stricture in front of the fistula, the urine having a free passage in that direction, ceases to flow in the other." (p. 487.)]

965. When, although the *urethra* has acquired its usual size, the healing of the fistula does not take place, and this depends on the callous or other condition of the fistula, together with the pus and urine escaping by

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(*a*) Bell, Benjamin, System of Surgery, vol. ii. p. 240.

(*b*) Richter, Anfangsgründe, vol. vi. p. 338. —Zang, Darstellung blutiger, heilkunstlerischer Operationen, vol. iii. pt. ii. p. 327.—Cooper, A., above cited.

(*c*) Desault, Œuvres Chirurgicales, vol. iii. p. 291.

the sides of the catheter, and collecting in it, the fistula must be opened with a bistoury upon a director introduced into it and connected with the groove of a staff passed into the bladder, so that the wound has a funnel-like shape, and its point corresponding with the internal opening of the fistula. If there be several fistulous passages, each must be divided with the director and bistoury. If the internal fistulous opening be very callous, it may be scarified, or touched with *tinct. lyttæ.* The wound may be either gently filled with lint, fastened with sticking-plaster, and a T bandage, or merely covered with a sponge soaked in warm water. The wound fills from the bottom by granulations, the scarring of which may be promoted by touching with lunar caustic.

[The continued in-lying of a gum elastic or silver catheter in the *urethra*, after the complete dilatation of the stricture has been effected, does not always lead to the healing *perinæal* fistula, for however completely emptied the bladder may be kept, a little urine will always flow by the side of the catheter, and dribbling through the fistulous passage, keep it open. But another circumstance also takes place, more especially I think I have remarked it, when a silver catheter has been kept in, and which, as **Brodie** has well observed, depends on "the catheter acting like a seton, inducing inflammation and suppuration of the mucous membrane of the bladder; and some of the *pus* which is secreted passes through the fistula and keeps it open just as much as it would keep open by the urine itself In some cases," he continues, "I have adopted the following method: I have made the patient draw off the water with a catheter three times a day, so that he should never make water except through the catheter, and thus that the urine should be altogether prevented from finding its way into the fistula. This is a better mode of treatment than the constant retention of a gum catheter in the bladder; and yet it will sometimes fail." (p. 488.)

In cases where a perinæal fistula is slow in healing, **Brodie** says, he has with some success, "endeavoured to stimulate the bottom of the fistula, so as to make that heal, whilst he took measures to prevent the orifice from healing prematurely. This was effected in the following manner: he melted a little nitrate of silver in a spoon of platina, and dipped the end of a probe in it; which being repeated two or three times, the end of the probe became covered with a varnish of caustic. Thus prepared, he introduced the probe quite to the other end of the fistula; and when he had done this, just touched the orifice of the fistula very slightly with the caustic potash. The effect of nitrate of silver upon a sore surface is not so much to make a slough as to stimulate it to contract, granulate, and heal, whereas the effect of caustic potash is, to make a slough and prevent healing." (p. 488.)

Upon the question, if a fistula exist in the *perinæum*, attended with some little contraction of the *urethra*, not giving the patient much inconvenience, so that it may not much attract his attention, "Are you to allow him to remain thus because the fistula is not very troublesome?" **Brodie** gives for answer, "Certainly not; for you do not know to what mischief it may ultimately lead. The matter on some occasions may not readily escape; it may burrow and cause sinuses in other directions, and may even do still greater mischief. Mr. **Vincent** and myself attended a gentleman who had suffered under a *fistula in perinæo*, and which he had neglected for a great many years. At last he observed the callosity around it grew bigger and bigger, so that it ultimately extended to the *scrotum* and *penis*. When we were called to see him we found him with a malignant disease, either *carcinoma* or *fungus hæmatodes*, which had clearly had its origin in the fistula, and had extended from that to the neighbouring organs. The patient ultimately died in great distress and misery." (p. 489.)]

966. If the narrowing of the *urethra* be such, that it cannot be got rid of in a space of time in which, by the reaction of the fistula upon the whole constitution, life is to be feared for, there remains nothing else than to introduce a staff into the *urethra*, down to the seat of stricture, which is to be held by an assistant. A director is then passed through the fistula into the internal opening, and the fistulous passage divided on it to the stricture, and this towards the staff. But if the fistula do not lead to the stricture, all the soft parts in the direction of the point of the staff must be cut into, and the staff thrust forwards into the bladder, into which an

elastic catheter may then be passed. If the *urethra* at the seat of stricture be completely closed and degenerated, a staff must be, as in the former case, introduced down to the stricture, and laid bare by a proper cut through all the covering parts, the hardened part of the *urethra* must be taken hold of with the forceps, and cut out with the knife or scissors, after which an elastic catheter is to be introduced through the *urethra* into the bladder, and properly fastened. The wound is either to be lightly filled with lint, or covered with a wet sponge. This operation is always difficult and dangerous; considerable bleeding, violent inflammation, and wasting suppuration and the like, may be its consequences. But it is certainly very rarely necessary, as with proper attention and perseverance, the most considerable stricture may be overcome, and by proper division of the fistulous passages, the obstacles preventing the cure may be removed.

[The operation of dividing the stricture, when it has become so tight that the urine will not pass by it, but only by the fistulous opening, is not, or ought not, to be attended with either difficulty or danger, but should never be undertaken without the Surgeon is well acquainted with the anatomy of the parts. It differs in no respect from the operation in the *perinæum* performed constantly, for cases of retention of urine from stricture, and which if there be either no extravasation of urine or but little, rarely do otherwise than well, and both retention and stricture are at once relieved. When there is perinæal fistula, there is more difficulty in the operation than in simple stricture, because the neighbouring parts are always thickened, and their natural character greatly altered; and also after the stricture has been divided, and a large catheter introduced into the bladder, the sides of the fistula having acquired a mucous-membranous-like character, are little disposed to heal unless their surface be destroyed and new granulations encouraged.

The operation is best performed by introducing the catheter down to the stricture, and then finding its point by cutting straight through the *raphe*, till the catheter point is exposed, which is to be the guide for the subsequent part of the operation. It is very advisable that the external wound should be free; a large clean cut wound heals almost as readily as a small one, and it is preferable, not only as giving the operator more room to act upon the part specially to be acted on, but also is less likely to slough, because the tearing and pulling commonly necessary with a small wound to make room, which cannot even then be obtained, almost invariably produces sloughing. When the point of the catheter has been found, the dissection is to be prosecuted backwards in the track of the *urethra*, and from time to time the wound must be examined with a director or a female catheter, of which the point should be directed backwards and upwards, the patient being at the same time desired to force, so that the flow of urine may direct to the aperture in the *urethra*. It is also very good practice to introduce the finger into the *rectum*, so as to prevent the director or catheter being thrust into the *rectum* or between the bladder and *pubes*, which I have known done, and produce very serious consequences. With patience and tenderness the under end of the *urethra* may be generally found, and the catheter from the upper part of the *urethra* must be pushed through it into the bladder, and there left. I do not approve of cutting away the hardened part of the *urethra*, as recommended by CHELIUS, as it is quite needless, for the inflammation and suppuration, if not even the slight sloughing which may ensue, will remove this without further trouble, whilst cutting away the *urethra* is more likely to do harm than good, by increasing the cavity to be filled up, and consequently affording more opportunity for burrowing of pus. If the fistula have been of long standing, it may be necessary to brush its surface over with caustic, to destroy its mucous character. —J. F. S.]

967. In a *fistula of the urethra or bladder, communicating with the rectum, (Fistula recto-urethralis et vesicalis,)* and consequent on wound, as in cutting for the stone, puncturing the bladder through the *rectum*, in rough catheterism, or long continued in-lying of a catheter in the bladder, from foreign bodies in the *rectum*, or from suppuration, especially in old persons, and the like, the urine mostly escapes by the *rectum*,

which causes inflammation and excoriation, and an evil reaction upon the general constitution; or on going to stool, some thin fæcal matter, often only wind or apple or grape-stones, even cherry-stones, which I have noticed in one case, pass through the *urethra*. If the fistulous opening be neither large, nor of long standing, and the constitution of the patient not bad, nor himself old, it may be hoped that by the continued in-lying of an elastic catheter unstoppled and properly fastened, by placing the patient on his side with his buttocks raised, by constantly emptying and cleansing the *rectum* with clysters, by observation of great quiet and a strengthening regimen, the closure of the fistula may be effected. This, however, rarely happens, specially in old persons. If this fistula result from wound of the *rectum* in cutting for the stone, so is its division from the point of injury to the end of the *rectum*, its most proper treatment (1). Dupuytren (*a*) has in recto-vesical fistula effected complete cure, or at least considerable improvement, by applying the actual cautery and caustic remedies; in which he introduces his *speculum ani* (a metallic ring) well oiled into the *rectum*, seeks for the seat of fistula, and then introduces the cautery into the fistula, even to the bladder. The lunar caustic is to be used in the same way. After forty-eight hours, the cauterization is to be repeated. In the interim, attention must be paid to the removal of the urine and fæcal matter by cooling diet, by the careful use of soothing clysters, and by the introduction of an elastic catheter into the bladder. Five or six cauterizations are often sufficient to improve the ailment, so that the escape of the urine is much diminished. The application of caustic may be avoided by cutting the *sphincter* muscles on one or both sides (Jaëger.)

(1) Desault and Dupuytren have employed this mode of treatment with good result. Zang (*b*) considers it preferable to the division of the gut; I have not however, seen any cure result from it. I have seen a case in which, after the operation for the stone by another Surgeon, the fistula withstood this treatment with the in-lying of the catheter, but after a year and a-half, healed of itself.

In a recto-urethral fistula Astley Cooper (*c*) made a cut upon a staff introduced into the bladder on the left side of the *raphe* till he felt the bulb, then thrust a double-edged knife into the *perinæum*, between the prostate and *rectum*, so as to divide the fistulous opening, between it and the *urethra*.

[I have once operated for recto-vesical fistula with considerable benefit to the patient, and I think, had he allowed the treatment to have been persisted in, that he would have been perfectly cured. The object of my operation was, by dividing the *m. sphincter ani* from the fistula into the *perinæum* to produce perinæal fistula, which would be much more easily managed; and I had hoped that the circular fibres of the *rectum* above the divided *sphincter* would assume the function of a *sphincter*, and thus retain the stools. How far I succeeded the following recital will show; and I have been induced to give it at length, as it well shows the distressing circumstances attendant on cases of this kind.

Case.—S. B., aged 32 years, a labourer, of temperate habits and healthy, but very excitable, and subject to occasional attacks of *dyspepsia*, was admitted into Isaac's Ward *Oct.* 3, 1837. Seventeen years before he was cut for the stone by the lateral operation, and the *rectum* wounded in cutting into the staff. This did not seem to interfere much with his recovery, as a fortnight after the operation he was sitting up in a chair and able to help himself at a pump, but in doing this he found his trowsers wetted by the flow of urine through the *rectum*. When he got sufficiently well to move about, he could never pass his water, whilst in the upright posture, without wetting himself, as the urine passed more freely by the *rectum* than by the *urethra*. Since the operation he has never been capable of retaining his urine beyond two hours, more commonly for not more than one, and occasionally for a still shorter period. At times all the water is voided by the *anus*, and not more than a drop or two by the *urethra*. Between five

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(*a*) Ammon Parallele der französischen und deutschen Chirurgie. Leipz., 1823, p. 111.

(*b*) Above cited, vol. iii. pt. ii. p. 230.

(*c*) Above cited.

and six months after the operation he first observed fæculent matter in small quantities to pass from the *urethra,* whilst attempting to make water in the erect posture, and at the same time pressing on the *anus* to prevent the escape of the urine through it. Ordinarily, when he is costive, the motions pass in small bits from the *anus,* and small pieces about the size of peas, and occasionally longer, on an average, about a teaspoonful, are daily voided by the *urethra;* but this rarely continues for more than a day or a day and a-half at a time. Ever since the operation he has been much troubled with wind, of which night and morning he passes considerable quantity, which, collecting in the bulb, produces great pain till voided by the *urethra.* He always passes much mucus by the *rectum,* and sometimes also from the *penis.* Occasionally after connexion, he has observed a little moisture about the *anus,* with the usual sensation of water passing by it. The fistulous opening is sometimes sore, especially when the bowels are much relaxed, and then stools and urine mixed pass like pease soup from the *urethra.* About four times within the last eleven years there seems to have been a gathering for about a fortnight, during which no wind passed by the *urethra,* and he suffered great pain till the wind again escaped. This was soon followed by blood and pus, after which he got better, and went about as usual. He now never leaves his bed without it being wet, the urine having flowed unwittingly through the *anus,* as he supposes; and, in making water, he is obliged to sit on a chamber-pot, to avoid the inconvenience of the water streaming down upon him. Occasionally he has heat at the lower part of the *rectum,* hardly amounting to scalding, and he thinks that in the last four years the quantity of stool passed by the *urethra* has increased. When a catheter is introduced through the *penis,* the point passes directly into the *rectum* by a narrow slit, about an inch and a-half long, immediately above the *m. sphincter ani,* unless by the finger previously placed in the gut, the tip of the instrument be lifted up and prevented entering. On consulting with my friend Green, whose patient he was, it was determined that I should perform the following operation, on

Nov. 18. Having bound him and placed him on the table, in the same posture as that for the lateral operation for stone, the forefinger was introduced by the *rectum* into the fistulous orifice above the *sphincter,* but its tip only could penetrate into the cavity of the bladder, after passing for about an inch seemingly along the opened under-surface of the prostate part of the *urethra.* A staff was then passed by the *penis,* and its tip having been tilted by the finger into the bladder, was held as in the operation for the stone. A curved blunt-pointed bistoury was next passed on the finger into the *rectum,* and thence into the fistulous opening till its extremity lodged in the groove of the staff, towards which having turned its edge I cut through the *sphincter* by drawing the knife to the *perinæum,* and then removing the staff, the finger readily entered the bladder. For the purpose of obtaining a complete view of the fistulous opening, Weiss's *speculum vaginæ* was passed into the *rectum,* and the aperture was then found to be an inch long, and half an inch wide, with a rounded and very thin edge; but it was requisite to continue the opening of the *urethra* still more forward into the *perinæum,* before the fistulous opening was sufficiently exposed to permit the paring of its edge. I first, however, separated each side of the wound in the *rectum,* from its connexions with the neighbouring parts, which on the left side, where the cut in the former operation had been made, was of a gristly hardness. The bleeding from these edges was free, a vessel or two required tying, but they continued oozing freely, and were only checked by repeated bathing with cold water. The upper part of the fistulous aperture was then seized with Lisfranc's tentacles, drawn down, and about half an inch of it cut off, which was followed by free bleeding, probably from the veins at the neck of the bladder. The sides of the upper part of this wound were then brought together with a single interrupted suture, so as to shut off the communication between the bladder and *rectum;* but the lower part was left alone, the object being to endeavour to establish a fistulous opening in the *perinæum* as the most likely mode of closing that between the *rectum* and bladder, and to render this more likely, the wound in the *perinæum* was continued forward till the *urethra* was opened as far as its passage through the triangular ligament of the *pubes.* A female catheter was then passed by this opening into the bladder, but as bleeding continued after he was put to bed, it was withdrawn, and having a collar of sponge wrapped round, it was replaced, in hope that the swelling of the sponge would compress the bleeding vessels.

About six hours after the operation, he voided by the catheter some very bloody urine, soon after felt sick and faint, and almost immediately had two gushes of clotted blood, (about half-a-pint,) accompanied with air from the *rectum.* He complained of much pain in the loins, and of being distended with wind. As I thought the swollen sponge might have prevented the escape of the air as well also of the blood, and might perhaps be exciting the disposition to bleed, I removed it, and directed that the plug should be removed from the catheter hourly and the water drawn off.

He went on tolerably well except being teased with flatulence and a tiresome cough. On the *third* day the wound began to discharge; he has been passing plenty of clear urine by the catheter, often accompanied with air; but on the day following some was noticed to pass by its side, especially whenever he coughed. On the *fifth* day a small portion of hard stool was passed, whilst he was emptying his bladder, and a considerable quantity of fluid motion was on the sheet. This was the first relief after the operation, for although he had taken a little confection of senna with the view of expelling the wind, it was thought advisable to keep the bowels as quiet as possible. On the *seventh* day he was going on well, still passed air with his urine, but in less quantity. An injection was given this evening to clear the lower bowel, but it had not any result. One ligature came away. On the following evening he had a plentiful solid motion which gave him much pain; his cough having become very troublesome, syrup of poppies and mucilage were ordered. On the *ninth* day the catheter was removed, and having been replaced with a shorter one, four ounces of urine were evacuated without any air, but afterwards both were again passed as usual. On the *twelfth* day he felt much forcing pain as if the bowels were loaded, though he had a good motion last night, and he has twice this morning passed some stool as well as air by the catheter. In the afternoon the bowels were freely moved, after which no more motion passed by the instrument. On the *seventeenth* day a fresh catheter was introduced; and on the *twentieth* he complained of much irritation in the *perinæum*, which when examined appeared to depend on the shoulder of the catheter having caused a little ulceration in the cleft of the buttocks. As regards the parts operated on, the external wound is healing fast, but the fistulous opening does not seem much altered. The catheter was removed, and an elastic male catheter passed by the *penis* to encourage the healing of the perinæal wound. This did not answer the purpose so far as the relief of the bladder was concerned; for the urine did not pass through it, but some by its side, through the *urethra*, the greater quantity however escaped by the *rectum*. On the evening of the *twenty-second* day, not a drop of urine having passed through the catheter, the dresser thinking it might be stopped up, and that there might be retention, withdrew it, and introduced a silver catheter; but very little water having been obtained, he replaced the elastic catheter, through which, since the urine flowed freely, and on the *twenty-fourth* only passed into the *rectum* whilst he evacuated his bowels. On the *twenty-ninth* day his bowels having become loose, the catheter began to slip into the *rectum*, and have stool pass by it. This continuing for several days, the catheter was entirely removed, after which he began to pass about a table-spoonful of urine, at each watering, by the *penis*, but the greater part escaped by the *rectum*. For the first two hours after taking drink, he was making water every two hours, but after that time much less frequently. After *two months* he began to get up; he now retains his water for an hour and a half or two hours, but voids it both ways. Four days after the water was held for a longer time, did not pass off as he walked about, but after sitting it oozed from the *anus* when he got up. He still continued slowly and steadily mending, the quantity passed by the *urethra* being equal to that from the *rectum*. In the *thirteenth* week I examined the parts with a *speculum;* the fistulous opening is about three-eighths of an inch in extent, its edges perfectly scarred and puckered. For the purpose of inducing contraction, lunar caustic was freely applied. During the following week more urine passed by the *urethra*, and the edges of the wound were again touched with the caustic. Subsequently, at intervals of about a week, the edge of the aperture was continually touched with the nitrate of silver, and at the end of six months, when I again examined the *rectum*, the fistulous orifice had diminished to the size of a large goose-quill, but he still passed water by it, though varying in quantity. Soon after he left the house much relieved, but not cured by the operation, and I have since lost sight of him.—J. F. S.]

968. *Vesico-vaginal Fistula (Fistula vesico-vaginalis)* is almost always the consequence of inflammation and sloughing of the *vagina* in difficult labour with the head long wedged, or of instrumental delivery, in which the fistula may be produced in from twelve hours to fourteen days after the separation of the slough; more rarely it occurs from injury of the front wall of the *vagina* and of the bladder, by instruments or sharp bones in opening the head; from operations, as lithotomy and puncture of the

bladder by the *vagina*, from ulceration of the bladder by the continual pressure of a catheter, or of a rough angular stone, from ulceration of a mucous bag, (DIEFFENBACH,) and the like. The fistulous opening therefore mostly depends on loss of substance. The inconveniences are very great; the *vagina*, *nymphæ*, *labia*, and the inside of the thighs, are considerably inflamed, excoriated, studded with pustular eruption, burn and smart from the urine escaping by the fistula and the *vagina*. Often a stony mass collects between the *labia* and *nymphæ*, and excites much pain; on account of the patient's continual wetting and the soaking of her clothes, her position and so on, a very offensive smell spreads about, which cannot be avoided by any precaution, or by the most exceeding cleanliness, renders her neighbourhood, in the highest degree troublesome and unbearable, and banishes her to the most painful isolation. The bladder gradually loses its capacity, and the *urethra* becomes narrow.

969. The *diagnosis* of the fistula is always easy, on account of the mode of its origin and the symptoms mentioned, and is most distinctly determined by examination. If the forefinger be introduced into the *vagina*, a very large opening is most commonly found in the middle of its front wall, from the size of a bean to two inches and more, the direction of which is mostly transverse, rarely vertical; but of the latter at least I have never seen an instance. According to the different size of this opening it may be felt merely with the finger, or seen on examination with the *speculum vaginæ*, or it may be penetrated by the forefinger, or by several fingers into the bladder. With so large an opening it is usual for the fore part of the bladder to protrude as a reddish bladder-like swelling into the *vagina* or between the *labia*. The aperture is situated for the most part an inch above the orifice of the *urethra*, but it may be higher or lower; it may correspond to the *urethra*, in which case the urine will be passed voluntarily, and escape only in part by the fistula. Stones may escape by the fistula, and incrustations form upon the internal surface of the bladder, (JAËGER,) as well also as in the *vagina*. The canal of the *vagina* above the fistula may be natural, or, as I have often found it, narrowed by adhesions in various ways, and even entirely closed; the neck of the womb is often drawn awry, nearly destroyed, and the mouth of the womb itself grown together.

970. The *prognosis* in vagino-vesical fistula is always very unfavourable, inasmuch as the continual wetting of the fistulous edges with urine prevent it closing; this, however, must always be attempted, especially when the opening depends on considerable loss of substance. Although of late the numerous attempts to cure these fistulas have presented only some successful cases, yet in the very sad condition in which the patient is placed by this fistula, and in the inadequacy of palliative remedies by means of receptacles for the urine, and so on, the further perfection of this treatment is to be considered as most highly important and to be desired.

The various urinary receptacles which have been proposed by DZONDI, as well as the obturators of BARNES, SCHMITT, BURCHARD, EARLE, and DUGÈS, by means of sponge and elastic flasks, by cylindrical or other shaped pessaries, or by means of a piece of gut filled with air, are either of no effect or improve the condition of the patient very little. I have only once succeeded by the aid of an elastic bottle, upon which a sponge was fastened to retain the urine, so that in standing or walking it did not escape, and could be voluntarily discharged.

971. The *cure* of vagino-vesical fistulas has been attempted in various ways:—1st, *By drawing off the urine, and compression of the fistula*;

2nd, *by cauterization;* 3rd, *by stitching;* 4th, *by the uniting apparatus;* and 5th, *by transplanting skin.*

972. For drawing off the urine, a sufficiently large elastic catheter should, according to Desault (*a*), be introduced into the bladder, fixed to an apparatus resembling a truss by means of a movable silver plate, provided with an aperture for the removal of the catheter; and to bring together the edges of the fistula, a tent of linen, or a sort of glove-finger stuffed with lint and smeared over with resin or wax; or a bottle of elastic resin, on the front of which a thin piece of sponge is sown, dipped in oil, and the sponge smeared with *cerat. calam.* (Baines) (*b*); or a sponge, (Guthrie,) or an elastic oval pessary, (Rognetta,) or a hollow resinous cylinder, (Coxe,) introduced into the *vagina*, which it fills up, but does not stretch. During this treatment the patient must avoid lying on her back; and the cure is rarely effected before six or twelve months. Although by this method several successful results have been obtained (*c*), in most cases it does not succeed, especially if the fistula be old, callous, and round; by the frequent removal of the plugs from the *vagina* the cure is always disturbed, and the length of time it requires, in many cases cannot be borne. Jaëger doubts the cures of old fistulas by this treatment, as mentioned by Desault.

973. On the failure of this treatment, for the purpose of effecting the cure most effectually, and in the shortest time, the cauterization of the edges of the fistula with caustic or with the actual cautery has been practised, in order by the inflammatory swelling, suppuration, and granulation, to effect its diminution and gradual closing. Dupuytren (*d*) introduces his *speculum*, open above, into the *vagina*, with its aperture upwards, and then with a hot iron, or with a piece of nitrate of silver or caustic attached to a thin rod, touches the orifice of the fistula for a minute, after which lukewarm water is to be injected. Often a similar application is necessary in from five to eight days. The position of the fistula may be illuminated by a candle held before it (*e*). Lallemand (*f*) first takes an impression of the fistula with modelling-wax, for the purpose of fully understanding the extent of the opening, and its distance from the entrance of the *vagina*. Afterwards he carefully touches the edges of the fistula with nitrate of silver, by means of a caustic-bearer fixed on a ring, and thus produces a sufficient degree of inflammation. When the slough is thrown off, and the edges of the fistula have become red, swollen, and suppurating, he introduces his connecting catheter, (*sonde-airigne*,) which draws off the urine from the bladder, and at the same time holds hooks, which are fixed in the hind edge of the fistula, whereby the two fistulous edges are brought together and kept in contact. If one application of the instrument be not sufficient, it must be repeated. The changed condition of the fistulous opening, and its progressive scarring, is ascertained by the repeated application of the modelling-wax. Cauterization can specially have only a satisfactory result when the fistula is small and surrounded

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(*a*) Above cited.

(*b*) Case of the successful treatment of Incontinence of Urine, consequent to sloughing or ulceration of the bladder from injury during labour; in Med.-Chir. Trans., vol. vi. p. 582.

(*c*) Desault, Barnes, Young, Guthrie, (Edinburgh Medical and Surgical Journal, 1824, April,) Bretschler and others.

(*d*) Ammon, above cited, p. 114.

(*e*) Sabatier, Médecine Opèratoire. Nouv. Edit., vol. i. p. 49.

(*f*) Réflexion sur le Traitement des Fistules Vesico-vaginales, nouveaux moyens d'union applicables à celles dans lesquelles la perte de substance est considérable; in Archives générales de Médecine, April, 1825, p. 481, pl. i.—Froriep's Notizen, No. 232, p. 186.—Chirurgische Kupfertafeln, pl. clv.

with much hardness, and especially, according to Dieffenbach, if it be high up in the *vagina*, where the suture is inapplicable, and the neck of the womb participating in the burning, and thereby swelling, assists the union.

Sanson describes a peculiar apparatus for illuminating the *vagina* after the introduction of the *speculum*.

Dupuytren has also a connecting catheter, projecting wings on both sides instead of hooks. Naëgele's and Laugier's connecting forceps.

974. Sewing up the vesico-vaginal fistula, after having previously refreshed its edges according to the proposal of Roonhuysen (*a*), as practised by Fatio (*b*) and Voelter (*c*), but not since thought of, and in which Naegele (*d*) proposed different modes of proceeding, Schreger (*e*) followed out successfully, has been frequently of late, and with various modifications, performed, but rarely with success. Wutzer (*f*) has had the greatest success, (of eighteen operated on, three were radically cured and the rest improved,) who, by the careful and precise detail of his observations and trouble, accompanied with rare perseverance, has importantly contributed to perfecting the operation, and, by the addition of *paracentesis vesicæ*, in order more completely to draw off the urine, has advanced considerably farther than his predecessors. The performance of the operation for vesico-vaginal fistula is always difficult, and may be even dangerous, from severe inflammation of the bladder and *peritoneum*. The difficulty of the operation is increased by the high situation of the fistula and by the narrowness of the *vagina;* so also the improbability of its success is in large openings with thin edges, with the whites, with the urine not properly drawn off, and in a bad constitutioned patient. If there be adhesions of the *vagina* these must be first divided, and any incrustations in the *vagina* or bladder removed. If the patient still menstruate, the operation must be undertaken two days after it has ceased. The intestinal canal must be cleansed by purging or clysters. According to Wutzer, the operation is only to be undertaken in fine weather.

975. The patient should be placed on her belly upon a table covered with a mattress, so that she may kneel near its edge, with her head and chest bent forwards, and supported with small bolsters. The operator sits between the patient's thighs, upon a seat of proper height, so that his arms should not soon tire. To widen the *vagina* and render it sufficiently open, a blind hook should be introduced into it, and the *perinæum* raised with it, by an assistant. The *labia*, together with the sides of the *vagina*, are to be drawn outwards by other assistants, standing on either side, either with the fingers alone properly applied, or with slightly bent hooks.

The position of the patient on her belly is much preferable to that on the back, (as in the operation for the stone,) which has been recommended by most persons, as the performance of the operation is rendered considerably easier, although for the patient it is more irksome than on the back. The widening of the *vagina* with a *speculum* in the way proposed, is also preferable. (Wutzer.)

976. According to Wutzer's method for refreshing the edges of the fistula, the most conveniently situated part should be seized with a long-

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(*a*) Heebkonstige Anmerkingen. Amst. 1663.

(*b*) Helvetisch-vernünftige Wehmutter. Basle, 1752.

(*c*) Neue eröffnete Hebammenschule. Stutt. 1722.

(*d*) Erfahrungen und Abhandlungen aus dem Gebiete der Krankheiten des weibl. Geschlectes. Mannheim, 1812, p. 369, vol. i. ii.

(*e*) Annalen des chirurg. Klinikums auf der Universität zu Erlangen. Erlangen, 1817, p. 78.

(*f*) Ueber die Heilung der Blasenschiedenfistel; in Organon für die gesammt Heilkunde, vol. ii. pt. iv. — F. Büttgenbach, Dissert. de variis fistulæ vesico-vaginalis operandi methodis. Bonn., 1841.

stemmed slightly curved sharp hook, and brought into a suitable position; a line is then to be drawn with the point of a fine pointed scalpel around the fistulous opening, and from three to four lines distant everywhere from it. The portion of the mucous membrane of the *vagina* between the line and the fistulous opening is then to be seized with the hook somewhat raised, and gradually removed about the whole extent of the opening as thinly as possible, to the breadth of three or four lines, by a saw-like motion of the scalpel, and the bleeding which ensues is to be checked by the injection of cold water.

By DIEFFENBACH, the patient is put in the same position as in cutting for the stone, a silver catheter is introduced into the bladder and held by an assistant, and a two-armed *speculum vaginæ* passed, in order to see the fistula distinctly. If the fistula be not high up, one of its edges may be seized after another, with a hook, or with a pair of hooked forceps, gently drawn down, and removed with a proper bistoury or pair of scissors. If the fistula be high up, DIEFFENBACH, after introducing RICORD'S *speculum*, passes one pair of hooked forceps into the wall of the *vagina*, above the fistula, and a second pair of hooked forceps beneath it; the *speculum* is then removed, and the *vagina* gently drawn with double hooks, if there be considerable tension, by an assistant, to one side, till the edges of the fistula are apparent between the *nymphæ*. About the edges little hooks are to be introduced, and both double hooks and one pair of forceps removed; the other pair is held by an assistant, and the little hooks by another person. A small scalpel is now thrust through the mucous membrane of the *vagina* and bladder, distant a line from the fiistulous aperture, and a strip, a line broad, is to be removed around the opening, and the hooks again introduced into the bleeding edges. The edge of the bladder is now to be taken hold of with a fine pair of hooked forceps, and a portion, two lines wide, removed with the knife, so that the wounded surface, which was only one line wide, is now four lines. In small fistulas, where the separation of the two walls is not possible, a funnel-like piece should be removed.

HOBERT (*a*) refreshed the edges by touching with lunar caustic.

Peculiar instruments for refreshing the edges (NAËGELE'S bistoury with a covered edge, LALLEMAND'S hook-shaped knife, and so on) are unsuitable and unnecessary.

977. For uniting the refreshed edges, the twisted, the glover's, the interrupted and the running stitch have been proposed, and with different modifications employed; the twisted and the interrupted are most convenient. The latter is easier of application; soft threads only and not hard metallic threads being employed, the threads are easily withdrawn; on the other hand the twisted suture renders the union much closer and does not allow the urine to percolate so easily; therefore WUTZER prefers it, in a quiet intelligent patient, for a narrow *vagina* and soft fistulous edges. In using the twisted suture, the insect-needles should be fresh sharpened and pointed, just before the operation, but they must not be too fine. The needle in the needle-holder should be introduced at such an angle as suits generally the position of the fistula; its point should not project further than necessary. It may be requisite, in order that the movements of the needle be not prevented, to grip it with the needle-holder close to the head. The tip of the forefinger of the left hand is to be placed near the edge of the fistula, and so directed that the entrance of the needle

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(*a*) London Medical Journal, 1825, Dec. p. 439.

should be as advantageous as possible. In transverse fistula it is best to pierce the hinder (upper) lip of the wound first, but in longitudinal fistula that next the left side of the *pelvis*. The left forefinger then presses the corresponding lip of the wound against the point of the needle, till it pretty well holds it. The other needles are to be introduced in a similar way, and the distance between the several needles should be no more than two and at farthest three lines asunder. The tying of the threads is to be effected with the two forefingers, but if they cannot reach, with the forceps. In the application of the interrupted suture, the curved needle, properly fastened in the needle-holder, and supported by the left forefinger is to be thrust through both lips of the wound at proper points; for which purpose, frequently the edges of the wound must be fixed with a sharp hook, as otherwise they easily give way. As soon as the needle is introduced through both lips up to its eye, an assistant frees it by turning back the screw of the needle-holder; the eye and the thread are then to be oiled, the holder withdrawn, and the point of the needle seized with the forceps, and about eight inches length of thread introduced. Both ends of the thread may be advantageously used for arranging the edges of the wound whilst applying the other stitches. If several threads have to be introduced, it is convenient that they should be of different colour, so that they may be more easily arranged. The needle threads must be first tied and drawn together with the fingers, or if deep, with the forceps. If the first tie loosen before the second is drawn together, it must be kept tight with forceps by an assistant. The threads must be cut off an inch from the knot. In introducing the needle it should be remembered, that the edges of the wound are to be taken hold of so far from the needle, that they may be penetrated *without ever* piercing the mucous membrane of the bladder. By this treatment the two wounded surfaces are applied to the height of three or four lines, and their free edges at the same time turned inwards towards the bladder, permit the urine to come in contact with the seam only in the most untoward cases. In this way, according to **Wutzer**, the very difficult separation of the bladder from the wall of the *vagina*, which here and there, from the great thinness of the tissue, must be quite impracticable, is superfluous. **Dieffenbach** draws with curved needles seven threads from the hinder to the front end of the fistula when drawn down, of which only one holds the edges of the *vagina* and the other, those of the bladder. The threads which have been passed are to be properly tied with the fingers, their ends brought out and fastened in the *mons Veneris* with sticking-plaster.

The twisted suture is proposed by **Naëgele** to be made with curved needles; **Roux** employs the common hare-lip needles; **Schreger** uses the glover's needles and suture. **Ehrmann** (*a*) first introduces on the inner side of the fistula some cross threads, then scarifies, and brings it together by tying the threads. **Kilian** so introduces the needle near the front angle, three lines from the edge, that its convex surface is directed towards the operator, pushes it backwards in the direction of the length of the fistula, and again passes it out at the same place, draws it out with the forceps, and brings back the threads to this side. In this way the threads are introduced on the other side, by which the first thread may be employed for drawing down the fistula. The several opposite corresponding threads may then be tied.

The conveyance of the needle with the fingers, or, where necessary, with a needle-holder, is preferable to the long stemmed trocar-like needle, from the eye of which the ligature is drawn out with a pair of forceps. (**Naëgele**, **Lallemand**, **Deuber**, and

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(*a*) Répertoire Génèrale d'Anatomie et de Physiologie Pathologiques, vol. v. pt. ii. p. 172. **Froriep's** chirurg. Kupfertaf. ccxxxv.

others.) The drawing together of the threads, by passing them through several rosary beads, and tying upon them, (SCHREGER,) or with the ligature tyer, is improper.

For the cases in which, on account of the thinness of the fistulous edges above described, the separation of the *vagina* from the bladder is not possible, DIEFFENBACH recommends the running stitch, in which without previously refreshing the edges, a very thick thread is carried by a curved needle circularly around the fistula, some lines distant from its edge, through the cellular tissue connecting the *vagina* with the bladder, in which the needle must be passed in and out three or four times through the same opening; the thread is then to be firmly tied. (Compare *par.* 957.)

978. For the purpose of carrying off the urine with greater certainty from the wound thus brought together, puncture of the bladder above the *pubes* should, according to WUTZER, be performed. The patient must be removed from the position upon her belly to that on her back, and should be allowed some rest. She is then to be brought to the edge of the table, the thighs raised towards the belly, and after the still remaining urine is drawn off with an elastic catheter, the curved tube of the trocar furnished with a fishbone-plug, and oiled, is to be introduced through the urethra into the bladder; the round head of the plug is then placed against the front wall in the direction towards the arch of the *pubes*, pressed pretty firmly on the hind surface of the lower notch of the *synchrondrosis*, and there kept some time constantly close to the pubic *symphysis*, raised along it from below upwards, till at last it can be felt through the abdominal coverings immediately above the *pubes*, and *directly in its middle*. The operator then firmly retains the tube in his right hand, in the position just mentioned, places the tip of the forefinger and thumb of his left hand on either side of the projection artificially made above the pubic *symphysis*, and endeavours so to assist in fixing the extremity of the tube there pressed up; an assistant then withdraws the plug, and in its stead introduces a curved stilette into the tube, so far upwards till the two handles completely meet to each other, and the point of the stilette at the same time protrudes through the upper opening of the tube. At this important moment the operator with his right hand takes hold of the handle of the tube with that of the stilette, and with strong pressure thrusts the stilette in a corresponding direction upwards and forwards, through the front of the bladder and the wall of the belly. The accompanying tube he takes hold of at the same time, with the two fingers of the left hand conveniently disposed, keeps it steady, and then allows the stilette to be withdrawn by an assistant, who also immediately carefully removes the handle of the tube, by gently drawing them apart. The operator now changes both hands, draws the tube with his right hand out of the belly till the hinder extremity directed by the left hand enters the cavity of the bladder, between the orifices of the ureters, which can be ascertained by the careful introduction of the oiled tip of the finger into the *vagina*. For the purpose of keeping the tube in this position, it must be fixed immovably by means of wing screws, in the cleft of a previously well-fitted belly-girdle, after which the patient should be carefully conveyed to a bed previously prepared, placed on her belly, upon suitably cut out leather cushions, and properly buckled in it with suitable straps. In the gap of the bolster and beneath the point of the tube a basin should be placed to receive the urine flowing from it.

For the arrangement of the trocar and bed, see WUTZER, above cited, pl. iv. and v.

979. The *after-treatment* must have special reference to the prevention of inflammation. According to DIEFFENBACH, besides rest and antiphlo-

gistic diet, injections of cold water every half-hour, with a large syringe, through the catheter lying in the bladder should be made, and by an *œsophagus* tube into the *vagina;* cold applications on the region of the *pubes,* and according to the state of the constitution, blood-letting; if pain come on, leeches to the region of the bladder, and even in the *vagina;* emulsions with *aqua lauro-cerasi* and castor oil, with mucilaginous drinks. About the sixth day the ligatures are to be carefully removed with forceps and long scissors, and injections made with lukewarm chamomile tea. If the union succeed and there remain only a little opening in place of the early cleft, or one of the needle-holes, we must endeavour to close it, by touching with tincture of cantharides, and the like, or by the loop suture. According to WUTZER, the symptoms of inflammation coming on moderately, may be opposed by frequently drinking cold water, and careful injections. In more careful examination of the patient, together with the application of leeches, some doses of calomel, rubbing in gray mercurial ointment on the insides of the thighs, and the frequent introduction of small pieces of ice into the *vagina* may be sufficient against severe inflammatory symptoms. The latter remedy employed with a cautious hand, will be especially advantageous and diminish the still burning pain. In increased inflammatory symptoms, blood-letting, calomel followed with infusion of senna, and injections of luke-warm oil into the *rectum* are to be employed. When, however, there is no danger of threatening symptoms, constipation for four or five days is rather desirable, and if there be disposition to *diarrhœa,* it must be checked with opium. If the puncture of the bladder have not been made, or if the tube have again slipped from the bladder, a thin elastic catheter must be introduced through the *urethra* every hour or two, or even oftener, with frequent pressure to discharge the urine; WUTZER considers it most advantageous when the patient herself can do this; but if not, the introduction of the catheter must be carefully performed by an assistant; and only when neither is possible, should the catheter be allowed to remain permanently. When, however, not merely the disposition to inflammation of the bladder is much increased, but also, by the continued irritation, the mucous secretion in the bladder is so great, that particularly after the third day, the catheter is frequently stopped, against which injections are not sufficient, this instrument must often be changed. The sutures should be first examined three days after the operation; if about this time a needle or a thread be near cutting through it, must be removed. After the third day, the examination must be made daily, that according as suppuration comes on, the several threads or needles may be removed. In successful cases the scar acquires the desired strength in four days. After the removal of the threads or needls injections only of lukewarm water or of weak lead wash should be used.

980. The cure of vesico-vaginal fistula by *transplantation,* was first attempted by JOBERT, in a case where previously two attempts with suture had failed. By means of MUSEUX's forceps or a hook, he drew down the hinder edge of the transverse fistulous opening, pared it, and then did the same with the front edge. He next separated an oval piece of skin from the mucous membrane of the right *labium,* so that the flap at the edge of the vaginal aperture formed, by closing the cut, a neck of four lines broad. With a female catheter, he introduced a loop of thread through the *urethra,* up to the fistulous orifice in the *vagina,* and drew the one end of the loop out of the *vagina,* and the other by the catheter, out of the *urethra.* The

turned back flap was so folded, that its mucous surface touched itself, and through its double edge the end of the thread hanging out of the *vagina* was passed spirally with a needle twice, and so a plug of flesh formed with a raw surface. By drawing the end of the thread hanging from the *urethra*, the fleshy plug was pulled between the fistulous edges and properly pressed up with the finger. An assistant continued to draw the urethral end of the loop, whilst the operator, after refreshing, drew a thread forwards which had been introduced into the upper edge of the fistula, for the purpose of bringing it into contact with the flap of flesh. An elastic catheter was then introduced into the bladder, the ends of the thread fastened to a T bandage, (or with sticking plaster on the thigh,) and the wound covered with agaric. The patient was benefited, but not cured.

In another case, in which the transplantation was made from the *labium*, hair subsequently grew upon it, which excited inflation of the mucous membrane of the *vagina*, and obstructed *coitus*.

Subsequently JOBERT made the flap from the fold between the thigh and buttock; after ten or eleven days the patient could pass her water without the catheter, in the usual manner. After four or five weeks the flap was cut through, an inch from its base, whereupon it became black, which however it ceased to be, after throwing off a small slough. After two months the successful result is no longer to be doubted. For similar experiments on transplantation see WUTZER, above cited.

981. DIEFFENBACH endeavoured to close large fistulas by drawing the mucous membrane together. Without introducing a *speculum*, and after having returned the wall of the bladder through the fistula, and having introduced a sponge into the cleft, to prevent its reprotrusion, he seized one edge of the opening with the hook-forceps, drew it towards him, and supporting it with another hook, cut off a narrow slip from the edge, and also cut off the edge of the bladder, some lines distant from the edge of the *vagina*. He then, by means of his own palate-needles, carried two leaden threads through the edges of the *vagina*, without including the bladder, and drew them together till there was considerable tension, upon which he thrust the knife in upon the posterior and lateral part of the *vagina*, and drew it down in a straight line to the *nympha*, and then treated the opposite side in the same way, so that the breadth of the thus isolated part of the *vagina* was about a fourth of its whole width. In making this cut the finger was introduced into the *rectum* to prevent injuring it, and to make the cut sufficiently long and deep. The leaden thread being then drawn tighter till great tension was again produced; the edge was drawn forward with a hook, or with hook-forceps, and the cellular tissue connecting the *vagina* to the pelvis cut through with scissors or a knife, first on one and then on the other side, but without coming too near to the bladder. By continuously drawing the leaden threads, the edges were loosely brought together, so that no further tearing apart was to be feared, and the edges of the wound were united with the interrupted suture, made with a curved needle, and when the hindmost stitch could not be made with the hand alone, it was made with a needle-holder. When the whole cleft was closed the leaden threads were drawn close together, and cut off so that only two turns remained. A catheter with large openings on the sides was introduced, and the after-treatment conducted as above described.

In moderately large fistulas, when a small neighbouring fold of the bladder lies in the opening, and has already become adherent, DIEFFENBACH recommends that the edges should be inflamed, by frequently touching with *tinct. lyttæ*, and that the membrane of the bladder should be drawn with a fine hook into the opening. If at last it unite to the edge, its surface should be touched with lunar caustic, to render it more tough and hard.

There is still to be mentioned VIDAL's proposal of, in complete destruction of the *vagina* and wall of the bladder, bringing together the *labia*, having first pared them; after which care must be taken, by frequent introduction of the catheter, and, in menstruation, by injection, for clearing the urine and blood from the *vagina*. To the same purpose is HORNER's proposal (*a*) of drawing down the *uterus* into the *vagina*, and so to fasten its front that it may supply the loss of the bladder or its neck.

[Among the various plans of treating vesico-vaginal fistula, may be mentioned that of introducing a small Indian rubber bag into the bladder proposed by Dr. KEITH of Aberdeen (*b*), in consequenceof the following very remarkable case which came under his care.

Case.—J. S., aged thirty years, was admitted into the Aberdeen Infirmary, complaining of constant pain in the region of the bladder, and constant distillation of urine from the *vagina*. She was delivered in 1831 by the forceps, and fourteen days afterwards the urine came away through an artificial opening in the *vagina*. This continued for seven or eight years, when she plugged the opening with a pint-bottle cork, and for a time succeeded, and she enjoyed comparative comfort till the cork slipped into the bladder, and was followed by the usual symptoms of stone. For a time the urine flowed again through the fistulous opening, but as the spmptoms of stone became aggravated she regained the power of retaining her water, and this so entirely before the close of the year that she then passed the whole of her urine by the *urethra*. The irritation of the stone, however, became so intolerable that it was resolved to crush it by the screw lithotrite. The fistulous opening was then large enough to admit a No. 16-catheter, having once been large enough to admit a pint-bottle cork: When the stone and cork had been crushed, and the particles evacuated the urine again passed freely through the fistulous opening, which, however, had become sufficiently small to allow a button-headed cautery at a white heat to be applied to it, so as to touch at once the edge all around. This was repeated in six days, again in sixteen days, and lastly in twenty-two days, after which she continued quite cured. "Several points of interest attach to this case," says KEITH; "*first*, It affords convincing evidence, from the effect produced on the fistula by the presence of her calculus that were a foreign body of a smooth and unirritating character, of sufficient weight, introduced into the bladder in cases of vesico-vaginal fistula, the body would act as a bullet valve, and not only keep the patient dry, but actually *favour* the contraction of the false opening. After seven years, in the above case, the opening admitted a pint-cork, with so much ease that it slipped through but after a foreign body was lodged in the bladder, nine months sufficed to reduce the opening to less than one-third of its previous size, and it could only have been during the latter six months of that period that the cork could have acquired density and weight enough to operate as a valve-plug. I would suggest a small thin bulb or bag of Indian-rubber filled with mercury. Should incrustation happen in the progress of the cure, a squeeze with a screw-lithotrite, or percussor, or a long *œsophagus*-forceps would throw it off, and at last when the opening had contracted to such a size as to admit of its ready cure by the cautery, the thin bag could be easily burst or punctured, and then withdrawn by the *urethra*. *Secondly*, If asked why I deprived myself of the bullet-valve, while cauterizing in the above case? I reply, that the constant straining kept up by the rough stone, arising from the inflamed state of the mucous membrane of the bladder, kindled and kept up by its presence, obliged me to remove a source of irritation, sufficient to defeat, in more ways than one, any effort of mature adhesion. *Thirdly*, It is worthy of remark that the application of the actual cautery inside the *vagina* occasions nothing deserving the name of pain, and this observation I have had repeatedly corroborated. The heat of the reflected rays may be felt; but I have never found patients say that they really felt pain. *Fourthly*, It is advised by high authority to allow long intervals between each application of the cautery, that time may be afforded for the consequent contraction of the parts: the advice is judicious; but it applies chiefly to cases where the orifice is large, and where there is much to accomplish in the way of closing in. My bullet-valve will, in future, aid the process much in such cases; but I beg to remark that where we have a fistulous opening of the size of a female catheter, for instance, and where, as in the preceding and succeeding cases, we

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(*a*) American Journal, 1839. No. 7.

(*b*) Remarks on the Treatment of Vesico-vaginal Fistula; in London and Edinburgh Monthly Journal of Medical Science, vol. iv. p. 12; also in BRAITHWAITE's Retrospect, vol. IX. p. 164.

are able at once to make the edges approximate, then I would urgently advise the frequent use of the hot iron, so as to keep up a raw edge, as well as a complete closure, thereby to ensure adhesion and complete obliteration at once." (p. 13.)

[RECTO-VAGINAL FISTULA.

981.* Still more serious and distressing to the patient than the vesico-vaginal, is the *Recto-vaginal Fistula, (Fistula recto-vaginalis,)* in which the stools incontinently passing from the *rectum*, through an unnatural passage in the *vagina*, convert it into a *cloaca*, from whence they continually escape by the *vulva*. When from the discharge of stool by this aperture, it is suspected that a fistula exists between the *rectum* and *vagina*, its situation and extent may be ascertained by the introduction of the finger of one hand into the *rectum*, and a blunt gorget into the *vagina;* but if the fistula be very high up, a sound must be introduced instead of the finger; in the latter case, however, **Duparcque** prefers the *speculum vaginæ*, as by it, every part, even the most minute fold of the *vagina*, can be thoroughly examined. He also observes, that "injections are not to be despised, as they point out in the fistula, indications which cannot be so exactly determined by any other means. Thus the injection, which does not return by the *vagina* in stercoral fistula, otherwise very evident, shows that it is neither with the *rectum*, nor with the large intestines that there is a communication, but that it belongs to the small intestines. The nature of the matter escaping from the fistula, furnishes also a sign more or less positive of the region of the intestinal canal with which it is connected. Thus the matter is liquid and yellowish from the small intestines; thicker and containing portions of formed motions when the fistula is in the large bowels, and more especially when in the *rectum*. * * * If the gas formed in the small intestines differ materially from that in the large, it may also afford some guide to the seat of the fistula; the patient should therefore be put in a bath, and the gas collected and analysed." (p. 315.) "The tendency to spontaneous cure which exists in accidental openings, is especially remarkable in tearings of the *vagina*. As the neighbouring parts converge concentrically towards the solution, so does it diminish, narrow, and at last the opening entirely disappears. The development of the cellular granulations, which is a sort of lengthening of the tissue, contributes to fill up the space, and especially to form the scar. Thus fistulous openings, of which the size is so great as to do away with all hope of occlusion, are notwithstanding, more or less immediately closed, either spontaneously after all treatment has been given up as unavailing, or when it has been perhaps more injurious than beneficial." (p. 327.) A remarkable instance of this kind is mentioned by **Duparcque**, in which there was one aperture between the *vagina* and *rectum*, an inch and a half above the *anus*, through which the finger readily passed; and a second between the *vagina* and *urethra*, about an inch from the orifice of the latter, of an oblong shape, from seven to eight lines long and two wide. In four months from the delivery, the apertures had diminished to half the size they were of, at the preceding month, when first examined; and at the end of eight months, "nothing escaped into the *vagina*, and there was merely a slight depression indicating the scar of the wounds." (p. 331.) The only treatment in this case was great cleanliness, looseness of the bowels, quiet, and generous living.

Duparcque observes, that "the passage of the fæculent matter over these accidental fistulas, does not actually prevent their healing, but because the parts on which they are found are not favourably disposed to stretch by their distension, or displacement, to the concentric closing of the opening. Thus the use of sounds, pessaries, and obturators, produce no satisfactory results; but on the contrary, by keeping the walls of the fistulous organs asunder, they prevent the narrowing of the opening. (p. 331.) The passage of the stools over the fistula, is rather advantageous than detrimental to the scarring. In reality, their continual contact with the edges of the opening, excites an inflammation which prevents their scarring simply of themselves; it causes the development of cellular granulations necessary to fill up the space, and produce consecutive union. * * * But I repeat, the principal and most important indication consists in putting the perforated parts in a condition most suitable for the approximation of the edges of the opening." (p. 132–33.)

The principle here recommended was, however, carried out much more correctly in an operation for recto-vaginal fistula, first proposed and performed twenty-five years ago by COPELAND, and it is much to be regretted that he has not given to the public any account of it; for though he is well known as having been the original proposer, yet there have been only a few scattered notices of this operation in the works of other writers (*a*). He has, however, kindly informed me, that his first operation was for a recto-vaginal fistula consequent on delivery, and that it consisted in division of the whole *m. sphincter ani*, on *one side of the anus*, so as to produce incontinence of the stools, and quite away from the fistulous opening. The result of this was, that the contraction of the *sphincter* being destroyed, the parts surrounding the fistula were no longer acted upon by it, and the tendency of the fistulous opening to concentric contraction being not opposed, it gradually drew together till it had completely closed, whilst the divided *sphincter* uniting more slowly, at last recovered the power of retaining the motions, and thus a perfect cure was effected. He further informs me, that he has operated successfully five or six times, cutting one or other side of the *anus*, as might be convenient, but never dividing forwards towards the *vagina*, nor cutting through the fistula and *perinæum*, as the result would inevitably be permanent incapability of retaining the stools.—J. F. S.]

Besides the writers already mentioned on Vesico-vaginal and Recto-vaginal Fistula, there may be also compared

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982. A *Dislocation* (*Luxatio*, *Exarthrema*, Lat.; *Verrenkung*, Germ.; *Luxation*, Fr.) is the slipping of a movable bone from its natural articular connexion; and is distinguished from the separation of bones immovably connected with each other (*Diastasis*.)

983. The dislocation is either *complete* (*Luxatio completa*) when the corresponding joint-surfaces not at all touch, or *incomplete*, (*Luxatio incompleta*, *Subluxatio*,) when they are not entirely separated from each other, with which last must be reckoned *Wrenching* or *Distortion*, (*Distortio*, Lat.; *Verstauchung*, *Verdrehung*, Germ.; *Entorse*, Fr.,) in which the joint-surfaces are partially separated, but their natural condition is again restored by the strength of the muscles and ligaments (1). Dislocations are further divided into *simple*, (*Luxationes simplices*,) when unaccompanied by peculiar symptoms, and *compound* (*Luxationes complicatæ*,) which are attended with wounds, bruises, fractured bones, severe inflammation, suppuration and other dangerous symptoms; into *recent* (*Luxationes recentes*) and *old* (*Luxationes inveteratæ*); into *primary*, (*Luxationes primitivæ*,) when the displaced head of the bone remains on the spot whereon it had been first thrown, and *secondary*, (*Luxationes consecutivæ*,) when it is dragged up to some other position by the muscles;

into *congenital*, (*Luxationes congenitæ*,) and *acquired* (*Luxationes acquisitæ*.)

(1) Distortion has various degrees, according as the fibrous tissue, the synovial membranes, the vessels and nerves severally, or altogether, are severely stretched or torn through:—1st degree, Slight pain and gradual swelling of the soft parts; 2nd degree, Sudden and severe pain, swelling, and effusion of blood; and therewith, in 3rd degree Unnatural motion of the joint in all directions.

984. The *diagnosis* of dislocations depends on the disturbed function of the dislocated limb, and on the appearances produced by the bone when removed out of its socket. The most remarkable signs are, entire or partial loss of motion of the limb, with altered form and position; it may be shortened or lengthened according as the head of the bone is displaced in this or that direction, or it may be distorted, which depends on the contraction of the muscles, that, by the dislocation of the head of the bone, are most commonly torn and extended, hence rotation of the limb occurs on the opposite side to that on which the head of the bone is dislocated; the natural form of the joint is changed, the socket is empty, and the dislocated head forms an unnatural projection; the limb is fixed in its position by the stretched muscles, and can only with the greatest pain be moved, and often not at all. To these symptoms are added severe inflammation, pain, swelling, and effusion of blood in the neighbourhood of the joint. The determination of the dislocation is therefore more or less difficult, according to the superficial or deep situation of the joint, according to the nature of the dislocation and the degree of the accompanying swelling. A more remote effect of dislocation is a kind of crackling which depends on the effusion of plastic lymph into the joint and into the mucous bags, and may easily mislead to the presumption of fracture.

[The limb is not always at once immovably fixed after dislocation, even when at the hip-joint. I had a case of dislocation into the ischiatic notch several years since, and when I saw the man six or eight hours after the accident, there was so considerable motion of the thigh, which could be bent quite up to the belly, that I doubted the nature of the accident. On the following morning, however, the limb could not be bent upon the belly, and the other symptoms of dislocation being present, I made use of the necessary means and replaced the bone. I have also seen other examples of the same kind.

Sometimes if a patient be not seen for some hours after a dislocation, it is impossible to ascertain the nature of the accident, on account of the great swelling. The Surgeon should therefore be especially cautious to make further examination on the subsidence of the swelling, so that the patient may not suffer from his negligence.—J. F. S.]

985. The occasional *causes* of dislocation are external violence or violent contraction of muscles: The former either acts directly on the joint or on the end of the bone opposite, in which case the dislocation is effected more easily; and generally the bone is obliquely situated in reference to its socket, at the moment when the external violence acts. Dislocation specially occurs the more readily, as the parts about the joint and the muscles are lax and the motions of the joint not confined (1). For the latter reason dislocation of the upper arm is more frequent than that of the thigh; and dislocations of the hinge joints and of such as have broad opposing surfaces to their bones, in which the motion is restricted, are mostly incomplete. Old persons are more rarely subject to dislocation, because the heads of the bones are brittle and easily break; young persons also are rarely subject to dislocation, because their *epiphyses* easily break (2); in persons of middle age dislocation is most common (3).

[(1) Dislocations sometimes happen by mere muscular exertion, some accidental disposition of the bone occurring, by which the ordinary antagonism of the muscles is disturbed, and the efforts of one set become too great for the other. It is in this way that dislocation of the lower jaw is produced, most commonly in yawning; the jaw is excessively depressed, the temporal muscle is so twisted over the pulley that it has little power, and then the external *pterygoid muscles* pull the necks of the jaw forward, and throw the condyles on the articular eminences. Lawrence (*a*) mentions a dislocation of the shoulder having occurred from muscular action, the patient "had been sitting up in bed to take a dose of medicine, when stretching out the arm to take hold of the cup, without making any exertion, or taking up any particular weight, the *humerus* became dislocated. Now although the bone came out so easily, yet it did not go back into its proper situation with facility; for it required a pretty strong pull to return it." (p. 477.)

Dislocations may also result from the laxity of the ligamentous capsules of joints. Astley Cooper mentions one of a dancing-girl capable of throwing the knee-cap from the articular surfaces flat upon the side of the outer condyle of the thigh-bone, in whom this had been produced by violent exertion when a child. (p. 11.) And another case in which a young lad had had, whilst on board ship, his foot placed on a small projection on deck and his arm lashed tightly towards the ship's yard, and so kept for an hour, the result of which was that he had the power of readily throwing his arm out of the shoulder-joint, merely by raising it to his head; but it was reduced by very slight extension. (p. 13.) He also gives another case, on the authority of Brindley, in which a man of fifty years had a dislocation of the thigh which he was capable of producing and reducing at pleasure.

(2) My friend, the younger Travers, has informed me that he had in February 1843, a case of dislocation into the ischiatic notch, in a boy of five years old, who, whilst at play in a paved yard, slipped down and was unable to rise. He could neither walk nor maintain the erect posture. All the symptoms of dislocation were present; the head of the bone was resting upon or next to the margin of the ischiatic opening, not having as yet sunk into the cavity of the notch, which Travers considers, is always a secondary result of this accident. There was some mobility of the limb. The head of the bone was almost immediately reduced, by confining the *pelvis* with a strap upon a firm deal table, turning the child upon his sound (the left) side and making the usual extension, with slight rotation outwards and raising the knee. This is the earliest instance of accidental dislocation with which I am acquainted.—J. F. S.

(3) Malgaigne has made an interesting inquiry into the frequency of dislocation in the different joints, and from this it appears, that of 491 cases there were of—

Dislocations of

the shoulder	321	thumb	17	knee	7
hip	34	wrist	13	spoke-bone	4
collar-bone	33	fingers	7	knee-cap	2
elbow	26	jaw	7	spine	1
foot	20				

And also that from the age of two to fifteen years, dislocation of the shoulder occurred only once out of four dislocations, but after sixty years about once out of one and a half (*b*)].

986. In every complete dislocation, the capsular and other ligaments, as also frequently the tendons and muscles surrounding the joint are torn; only in great laxity of the ligaments of the joint, and large collections of *synovia*, is dislocation without tearing possible. If the head of the bone be soon returned to its natural position, in general there are not any decided symptoms; but if it remain any length of time out, of the joint, it acts as a foreign body on the surrounding parts, and the socket is gradually filled up. If it be in contact with the cellular tissue, it so compresses and thickens it, that it, as it were, forms a capsule around the head of the bone, whilst the torn ligaments are still attached to the surrounding parts; the muscles lose by pressure, their structure, their power of contraction, and becomes almost fibrous. If the head of the bone lie upon a bone, it forms a hollow in it, around the edge of which bony growths take place, by which the head is more or less perfectly inclosed. In such old dislocations the motions of the joint are always more or less interfered with, the nourishment of the joint suffers, it wastes, and the muscles become lax.

(*a*) Lectures in Lancet, 1829–30, vol. ii.

(*b*) Gazette Médicale.

987. The *prognosis* of dislocation depends on its complication, seat duration and cause. Simple dislocation may usually, by early assistance, be reduced, and in general is not dangerous; compound dislocation is, however, on the contrary, frequently accompanied with very dangerous symptoms, and according to the degree of bruising and tearing of the soft parts, according to the constitution of the patient and the like, it is often as necessary, as in compound fracture of bones, to determine at once on the necessity for amputation, or the possibility of preserving the limb. Dislocations in ball- and socket-joints are commonly less dangerous than in hinge-joints, although they are more difficult to reduce. In joints surrounded with strong muscles and ligaments, severe symptoms mostly occur.

The earlier the reduction of a dislocation is attempted, the more easily is it effected (1); this, however, must often be delayed, on account of the already existing great inflammation and swelling, though not too long, as the dislocated bone is always to be considered as the principal cause of these symptoms (2). In dislocations depending on palsy of the muscles and laxity of the ligaments, the reduction is easy, but its recurrence on the slightest violence is to be feared. In powerful or in old persons the reduction is more difficult than in young and weakly persons. From pressure of the head of the bone upon the nerves and vessels severe symptoms often occur; there may be either partial or complete palsy, or stiffness of the joint, and *anchylosis* may remain as consequence of inflammation.

[(1) My friend, Liston, tells me, that he once reduced, without assistance, a dislocation on the back of the hip-bone, two or three minutes after it had occurred, by the person having been thrown from his horse, simply by putting his hand on the *pelvis* and pulling and rotating the thigh with the other. This is probably an unexampled case, but it proves, that the earlier the reduction is attempted the less power have the muscles to offer resistance.

(2) The necessity for delay in the reduction of dislocation on account of the accompanying inflammation must be extremely rare, unless violent and unwarrantable efforts have been previously made without success. One such instance I have known, in which suppuration of the shoulder-joint ensued and the patient died, without the dislocation being reduced. But as a general rule, dislocations should be always reduced, and with the employment of moderate force there is little if any attendant danger.—J. F. S.]

988. The cure of dislocation requires, *the reduction of the dislocated head of the bone, the fixing it in its socket, and the removal of the symptoms.*

989. The *reduction of the dislocated head of the bone into its socket* (*Repositio*, Lat.; *Einrichtung*, Germ.; *Réduction*, Fr.) is to be attempted by extension and counter-extension, and by pressure on the head of the bone itself, which thrusts it into its socket.

The object of the extension and counter-extension is to counteract and lengthen the contracted muscles; therefore many recommend that the extension and counter-extension should not be made at the extremities of the dislocated bones, so that there should not be any circular compression of the muscles of the limb by which they may be excited to more violent contraction. This notion, however, is rejected by Callisen, A. Cooper, and other Surgeons. In certain dislocations, for instance those of the elbow-joint, the extension and counter-extension can only be effected on the dislocated bones themselves. The extension must always be made in the same direction as that in which the head of the bone was displaced, and with gradually increasing force, so as to tire the muscles; the position of the limb must specially be such as renders the muscles as lax as possible (*a*).

(*a*) Loder's Journal, vol. iii. pl. ix. f. i.

Voëlcker (*a*) effects the same by pressure of the air according to **Weber**'s experiments. (Compare *par.* 234.)

990. Extension and counter-extension are performed either merely with the hands, or by assistants with twisted cloths, properly applied upon the limb, above and below the dislocation, or with proper machines, among which the pulleys and **Schneider**'s extending apparatus are the best. If the head of the bone become more movable by gradual extension, and approach the socket, it often slips in of its own accord, and with a distinct noise; or it must be drawn towards the socket with the hands, or with cloths, in doing which the limb is brought into a position contrary to that of the dislocation. It must, however, be here remembered, that the parts of the joint be not injured by too violent motion, when the extension is not sufficiently made. The perfect reduction is indicated by the natural form and direction of the limb, the cessation of pain, and the freedom of motion.

[Dislocations which have existed for some time, although they may not be reduced by ordinary extension for an hour or two, may sometimes be reduced simply by tiring the opposing muscles, by attaching a trifling weight for some hours. The younger **Cline** in this way succeeded in reducing a dislocation of the shoulder which had been out for several weeks and could not be replaced by the common method, by fixing the shoulder and suspending a brick, attached to the hand, over the end of the bed. On visiting the patient next day, the bone had returned to the socket.

In making extension, caution must be employed, and no more violence used than absolutely necessary, nor ought the Surgeon to handle the displaced bone too roughly, as unfortunately is much more frequently done than should be. I have known a dislocated bone broken by coarse and unjustifiable attempts at its reduction, and cases are mentioned in which an artery has been torn through, all the soft parts lacerated, and palsy of the limb produced. And even when the extension has been very long continued, without great violence, but in a broken constitution, I have seen abscess in the joint and hectic fever destroy the patient. Caution, therefore, in making and continuing the extension is most important.—J. F. S.]

991. The obstacles which render the reduction of the dislocation difficult or impossible are, great inflammation and swelling, too small opening in the capsule, the peculiar form of the joint, and the long existence of the dislocation. In the former case suitable extension cannot be employed without occasioning dangerous symptoms; the inflammation, as in fractured bones, (*par.* 587,) must be first got rid of by general and local antiphlogistic treatment before proceeding to reduction.

A too small opening in the capsular ligament, is mentioned by many as hindering the reduction, and it is advised that by moving the limb in different directions, the cleft in the ligament should be increased (*b*). A. **Cooper**, however, entirely opposes this proposition, and believes only that some of the untorn ligaments prevent the reduction.

The form of the joint may render the reduction difficult when the edge of the head of the bone is pushed behind the edge of the socket, as, for instance, at the hip- and shoulder-joint.

Old dislocations always require previous blood-letting, baths, movement of the limb in various direction, a considerable and continued extension. Dislocations of ball- and socket-joints often after a month are unreducible; reduction has, however, been effected by great force after four and even six months. In hinge joints, after twenty or thirty days, the reduction is often no longer possible. It is, however, to be remarked on this point, that in old dislocations, if a very violent extension be employed, except in very

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(*a*) Worin liegt der Grund der geringen Beweglichkeit und der schweren Einrichtung der luxirten Glieder; in Hamb. Zeits., vol. vi. pt. ii.

(*b*) **Callisen**, Systema Chirurg. hodiern. vol. ii. p. 684.

emaciated, flabby, and old persons, the consequences of the extension are more severe than the advantage of the reduction. In young muscular persons, three months may be considered as the longest space of time, at which the reduction of a dislocation should be attempted. If the patient be urgent for an attempt at reduction, he must be made aware of the circumstances already mentioned, and the attempt must be made with caution, so that the muscles and nerves be not damaged. In old dislocations, a threefold obstruction may render it impossible:—1, union of the head of the bone with the surrounding parts, so that even after death, when the muscles are cut through, the head of the bone cannot be returned; 2, the socket may be filled up, in which case the head of the bone, even though reduced, cannot remain in its place; 3, if a new socket be formed in the bone upon which the head lies, so that without fracture it cannot be separated from it (A. Cooper.) (*a*).

[The length of time after the accident, at which a bone may be reduced, varies considerably, and depends on the form of the joint and the patient's muscular power. I am inclined to believe, however, they may sometimes be reduced at a longer period than two or three months, and that it is right to make the attempt, but the Surgeon should be pressed to the trial rather than press the patient Of course the more simple the form of the joint, and the more shallow the socket, the easier is the reduction, hence ball- and socket-joints are more readily replaced than hinge-joints, and the shoulder than the hip. Professor Smith, of New Haven, U.S., reduced one dislocation of the shoulder at seven months, and another at ten and a half months. There is an excellent statistical account (*b*) of the practice of Dupuytren in the Hôtel-Dieu at Paris, in which the twenty-three cases successfully treated by him varied from between fifteen and eighty-two after the accident. Breschet (*c*) mentions a reduction of dislocated hip at seventy-eight days, and three of the shoulder at the eighty-second, ninetieth and ninety-eighth day respectively; and in the Mémoires de l'Académie Royale de Chirurgie de Paris, vol. v. p. 529, is related a dislocation of the hip reduced after two years. —J. F. S.]

992. As the muscles mostly render difficult the reduction of dislocation, in many cases it can only be facilitated or rendered possible by diminishing their contractile power. This is effected by those remedies which have a disposition to produce faintness, or even fainting, as a smart blood-letting, (according to the state of the patient's constitution,) a warm bath, nauseating doses of tartarized antimonial wine, tobacco clysters, drunkenness, perhaps also opium (*d*), and by frightening (*e*), or diverting the patient's attention.

993. After complete reduction the head of the bone has usually no particular disposition to slip out again; this occurs only in violent motions of the joint, or when the dislocation depends on great weakness of the ligaments or muscles. The limb should be brought into a position, in which the muscles are relaxed, and such bandages applied will prevent its motions, and it should be kept quiet. Cold applications are employed to prevent or get rid of inflammation. When the inflammatory symptoms have passed by, careful movement of the limb is to be made, for the prevention of stiffness of the joint, by the long-continued rest.

[Sometimes after the reduction has occupied much time, the muscles are so completely tired out and deprived of their tone, especially in persons of lax fibre, that they will not retain the head of the bone in its place, and consequently the mere weight of the limb will reproduce the dislocation. For this reason, not merely are bandages applied immediately after the reduction, but the joint should be carefully examined without

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(*a*) Marx, Jusqu'à quelle époque est-il possible d'opérer la réduction des Luxations? Paris, 1829. —Von Froriep, Veraltete Luxationen vom Standpunkte der Chirurgie und med. Polizei betrachtet. Weimar, 1834.—Nevermann, Ueber die Nothwendigkeit, veraltete Luxationen einzurichten; in Hamburger Zeitschrift, vol. ii. pt. iii.

(*b*) Philadelphia Journal of Medicine.

(*c*) Répertoire Générale.

(*d*) Cooper, A., above cited.

(*e*) Dupuytren; in Ammon's Parallele, p. 170.

disturbing them, for the first two or three days, to ascertain that the parts are in their proper place. I have known an instance in which a dislocated upper arm after having been reduced and carefully bandaged up, was left undisturbed for some weeks, and on the removal of the bandages was found to have slipped out, and could not be reduced again.—J. F. S.]

994. The treatment in sprains is to be the same as for bruises. Cold applications are to be employed, with careful rest of the joint, general and local blood-letting, proportionate to the bruising and inflammation, and subsequently, for the complete dispersion of the extravasated fluids, spirituous and aromatic applications used. There often remains for a long while swelling, weakness of the joint, and, in old persons, a crackling in the joint, which is removed by volatile rubbing, douche bath, and the like.

[The two great auxiliaries in reducing dislocations, are bleeding and nauseating doses of tartar emetic. The bleeding should always be made in a large stream from one or both arms, according to his apparent strength, and whilst the patient stands upright, till he feels faint, which is best determined by his bursting out into a cold, clammy, sweat, and unless carefully noticed he drops on the floor before the Surgeon is aware. Immediately on the faintness occurring the extension should be made, the bandages and pulleys having been previously adjusted, if thought necessary; and it should be made steadily and not by jerks. Frequently the excitement of the pain revives him, and it is then advisable to give him a grain of tartar emetic every ten minutes, so as to keep him in a state of *nausea* till the reduction is effected. If the dislocation be of long standing it is well to reduce the patient's strength by spare diet and purging for two or three days previous to the operation; and on the same morning to give him nauseating doses of tartar emetic for some hours prior to the extension, so as to put him in the most favourable condition. And the French Surgeons are in the habit of applying poultices and other relaxing applications to a dislocated joint, for the purpose of rendering the parts more yielding some days before attempts at the reduction are made.—J. F. S.]

995. Dislocations *accompanied with tearing of the soft parts* covering the joint and *thrusting out of the head of the bone*, belong to those rare but most dangerous cases, in which severe inflammations, weakening suppuration, slough and nervous symptoms are to be dreaded. The danger is greater as the bruising and tearing of the parts of the joint are more severe, the older the patient, and the more out of condition his constitution. According to these circumstances the necessity for amputation, or the possibility of preserving the limb, must be determined. Amputation, however, may subsequently become necessary from wasting suppuration, from sloughing, and the like. If the immediate removal of the limb be not indicated, the head of the bone must be returned as soon as possible, and with the least injury of the parts of the joint; the wound must be completely closed with sticking plaster; the limb surrounded with compresses and with SCULTETUS's bandage, kept in proper position by the application of splints, and the patient must be treated strictly antiphlogistically, according to the state of his constitution. The wound often heals by quick union and without any particular symptoms. If suppuration ensue, the cure often takes place with an emollient treatment; but generally, if it be copious, it is accompanied with severe pain and nervous symptoms, and must be treated according to the rules laid down for wounded joints (*par.* 559.) If gangrene come on, it requires the proper treatment.

996. If the reduction of the head of the bone, protruded through the soft parts, be in no way possible, even after proper enlargement of the wound in the skin, nothing remains, but to saw off the protruding bone, by which the stretching and tearing of the muscles are relieved, and the joint can be brought to its natural position; after which the symptoms,

in general, soon and considerably diminish. When the reduction of a bone protruding through the soft parts is not immediately possible, it is still less so, when inflammation runs into suppuration; the symptoms continue increasing, and amputation may be rendered necessary by gangrene, and by progressive destruction, if the head of the bone have not been removed at the proper time.

997. When dislocation is connected with fracture of a bone, the latter must be always attempted to be set, if it can be done, without extension of the limb. If this be not possible, the fracture must be treated first, and on the length of time requisite for that purpose, depends, whether after union has occurred, putting to rights the old dislocation can be undertaken.

998. *Congenital Dislocations*, (*Luxationes congenitæ*,) noticed by HIPPOCRATES, AVICENNA, PARÉ, PALLETTA, SANDEFORT, and SCHREGER, at the hip-joint, where they most commonly occur, more carefully described by DUPUYTREN, and more recently the subject of numerous observations, have been since noticed in almost all the joints of the extremities. Very different opinions are held as to the causes and origins of these dislocations, principally however with reference to the congenital dislocation of the thigh. Most persons have considered them as defaults of formation, as the consequence of arrested development of the bones and their sockets (SCHREGER, DUPUYTREN, BRESCHET, and others.) Some have considered them as consequent on distension of the capsular ligament, and of misproportion between the bone and its socket thereon depending (E. STROMEYER) (*a*). Others ascribe them to the position of the *fœtus* in the womb, or to violence operating on them during birth (the AUTHOR, D'OUTREPONT, CRUVELHIER.) VON AMMON (*b*) grounds them on default of development; he does not however deny, that therewith in many cases is connected an original deficient condition, or a diseased formative process; and in like manner, may the ailment have a purely diseased origin, in certain, though very rare cases, and have no connexion with the fœtal development of the hip-joint. GUÉRIN (*c*) considers it as the product of an active or primary retraction of the muscles, the remote cause of which is to be sought in the affection of some central part of the nervous system. On the degree and form of the muscular affection, depends the degree of dislocation, as does its development and course upon many secondary circumstances, to wit, prevention of the development of the muscles following on their retraction, physiological contraction and vertical operation of the tendons.

999. The examination of the joint after death, has explained various changes, in the several tissues constituting the apparatus of the joint, as distension, tearing of the capsular, and other ligaments; diminution, flattening, distortion of the head of the bone; diminution of the socket, its filling up with a quantity of fat, flattening or entire disappearance; a more or less deep new cavity for the dislocated head; the muscles surrounding the joint contracted, shortened, and variously altered in their substance; considerable wasting in the affected limb. On examination soon after birth, tearing of the ligaments is found, but otherwise the natural form of the socket and head, and the joint especially, is as in acquired dislocation. (PALLETTA.)

(*a*) Ueber Atonie der fibrösen Gebilde und deren Rückbildung. Würzb., 1840.

(*b*) Die angeborenen chirurgischen Krankheiten des Menschen. Berlin, 1842, p. 113.

(*c*) Gazette Médicale, 1841. No. 7. 10. Recherches sur les Luxations Congénitales. Paris 1841.

1000. If the result of these examinations be used for the purpose of clearing up the way in which these dislocations originate, it must only be permitted us to draw conclusions from those observations which have been made soon after birth, as in old dislocations of this kind, still more decided changes must arise from the progressive development of the body, as well in the empty socket, as in the dislocated head, than in old dislocations which have occurred at a later period of life. But in the examination of such congenital dislocations at an early period of life, there are only such conditions of the parts of the joint as can be ascribed to the position of the *fœtus* in the womb, or to the violence which has operated during birth. An observation of CRUVELHIER'S (*a*) favours the first cause as regards congenital dislocation of the thigh-bone, an observation of PALLETTA'S (*b*) the second. This is still more decided as regards congenital dislocations in other joints, as resulting from several observations. The position of the *fœtus* in the womb, I consider, is the principal cause of this dislocation, and I believe, that the dislocation is effected by it, either directly, in a mechanical way, or that it gives rise to the prevention of the development of the parts of the joint, and therefore that the latter is not to be considered as a primary cause, but only as a consequence. The observations of D'OUTREPONT on the origin of this dislocation, from violence during birth, correspond with mine, and I find no contradiction to my long published opinion, in that which VON AMMON (*c*) has objected to it.

1001. The possibility of reducing congenital dislocation depends on the changes which the muscles have undergone in their dimensions, direction, structure, and texture, on the change in the ligaments and capsules, the head and surfaces of the joints, on the changes of the vessels and nerves, of the cellular tissue and skin, and on the changes of the bones in the neighbourhood of the dislocation. Reduction is to be effected by long continued and gradually increased extension by means of proper apparatus, and by properly fixing the head of the bone, in the socket, after it has been brought into it. If the several shortened muscles do not lengthen, and project considerably, extension should be assisted by cutting them through beneath the skin.

SECOND CHAPTER.—OF PARTICULAR DISLOCATIONS.

I.—OF DISLOCATION OF THE LOWER JAW.

(*Luxatio Maxillæ Inferioris*, Lat.; *Verrenkung der unteren Kinnlade*, Germ.; *Luxation de la Mâchoire inférieure*, Fr.)

BINKEN, Dissert. de maxillæ inferioris luxatione. Göttingæ, 1794.

ZERTAMINO, Ueber den wahren Mechanismus der Luxation der Unterkinnlade; in VON SIEBOLD'S Chiron., vol. ii. p. 349.

BOYER, Above cited, vol. iv. p. 77.

1002. The condyles of the lower jaw can be dislocated only in one direction, viz., forwards; the spinous process of the sphenoid bone prevents it inwards, the front wall of the bony auditory passage backwards, the impossibility of inward movement of the opposite side without frac-

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(*a*) Exercitationes Pathologicæ, p 88.

(*b*) Anatomie Pathologique, vol. ii. fasc. 1.

(*c*) Above cited.

ture outwards, and the horizontal surface of the temporal bone upwards. Most commonly both condyles are dislocated together, but frequently only one or other. At the moment when the dislocation occurs, the separation of the two jaws is very great, but gradually it diminishes to an inch or an inch and a half; the incisive teeth of the lower jaw project more than those of the upper, the lips cannot be closed, the spittle pours out in large quantity, the pronunciation of the tones, especially of the lip tones is prevented; a depression is observed in front of the ear-passage; on the inner side of the cheek a projection caused by the coronoid process; the natural prominence of the *m. masseter* is flattened. If the dislocation be only on one side, the chin is drawn in the opposite direction; on one side only, is the depression before the ear-passage observed, and the lips may be more closed; the speech, however, is faltering. If the dislocation be not reduced, the jaws often remain fixed in the separation already mentioned, but the patient gradually acquires the capability of speaking more distinctly, and of retaining the spittle, and swallowing with less difficulty. Chewing remains impossible, and the patient must be fed with fluid food; but in some cases the capability of chewing hard food has returned (BOYER.)

1003. Dislocation of the jaw takes place in some persons very easily, but never in children, on account of the peculiar form and direction of the jaws. Its cause is either external violence, which thrusts the chin downwards and backwards, when, at the same moment the muscles raising the jaw, especially *m. masseter* and *pterygoideus internus* contract; or violent straining in vomiting or yawning, by which the chin is violently drawn down, and by the simultaneous action of *m. pterygoidei externi* projected forwards.

1004. *Reduction* when effected early is easy. The patient should be seated on a low seat and his head pressed by an assistant against his breast. The two thumbs, wrapped in linen, are then to be carried as far back as possible, between the hind teeth, and put upon their crowns, whilst the fingers placed beneath the chin bring it forwards and raise it at the same time. If the dislocation be only on one side, the reduction is to be performed only with one hand, in the way described, but is more difficult than when both condyles are dislocated. For the purpose of acquiring great power in this proceeding, the patient may be seated on the floor (LE CAT.) If the reduction cannot be thus effected, a piece of cork may be introduced between the hinder teeth and the lower jaw pressed forward against the upper. If the dislocation be only one-sided, the cork is to be applied only on that side.

[The readiest mode of reducing a dislocated jaw is, to set the patient on the floor and fix the back of his head between your knees. Then the handles of a couple of forks, or two round pieces of hard wood of similar size, are to be thrust in, one at each corner of the mouth, between the hind teeth, as far as they can be got. You then place both hands beneath the chin, and drawing it directly and steadily up, the sides of the jaw forming a pair of levers, the contraction of the temporal muscles, which fix the condyles in their unnatural place, is overcome, and the reduction is easily effected. A little knack is requisite to raise the chin evenly, and keep the fork-handles well fixed, otherwise one condyle only will slip in, and the attempt to reduce the other, will often displace that first returned. With inattention to this circumstance, this will occur again and again to the annoyance of both patient and Surgeon.

If only one condyle be dislocated, it is still best to introduce the fork-handles on both sides.—J. F. S.]

1005. After the reduction is effected, the lower jaw should be fixed by the halter bandage or by a cloth folded together passed beneath it and tied on the head. The patient must for some days refrain from talking or chewing, must only take fluid food, and for a long time use it cautiously, and in gaping support the chin with his hand.

1006. The case may be considered as *subluxation of the lower jaw*, when from great laxity of the ligaments, the condyles escape over the edge of the inter-articular cartilages in the sockets of the temporal bones, and fix the jaw with the mouth somewhat open. Generally this accident is relieved by the natural efforts; it may, however, continue a longer time and yet the capability of moving the jaw and closing the mouth may be recovered. At the moment when this subluxation takes place the patient feels himself incapable of completely closing his mouth; he feels some pain, and the mouth on the affected side is least closed. Great depression of the jaw directly downwards is required to restore the natural position of the joint.

In great laxity of the ligaments, a snapping and some pain is felt in the joint of the jaw, immediately before the ear, when the jaw suddenly returns into its socket, out of which, on account of the looseness of the ligaments, it had escaped forward upon the articular eminences. Young ladies are most subject to this accident; it is best relieved by ammonia and steel, together with shower-bath and blistering, if the disease have existed some time (A. COOPER.)

1007. *Congenital dislocation* of the lower jaw was first noticed by GUÉRIN (*a*), in a *fœtus* with deficient formation of the brain. The stretching and shortening of the depressing muscles, and of the *m. pterygoidei externi* are remarkably opposed to the lengthening and thinning of the *m. masseteres*. SMITH (*b*) observed a congenital dislocation of the jaw on the left side, in an idiot from birth, and considered it as consequent on arrested development in the transverse root of the cheek-bone or of the articular eminence, so that neither socket nor articular process being present, the zygomatic process of the temporal bone was not formed, but that process of the cheek-bone was lengthened, the condyles of the lower jaw were deficient, atrophy of the articular processes of both upper jaw and cheek-bones, and the forward position of the orbits were changed. The case differed from dislocation by accident, in the mouth opening and shutting without hindrance, the lower jaw being movable to a great degree, as naturally, the upper jaw overhanging it, the coronoid process forming no prominence, and the speech not interfered with.

II.—OF DISLOCATION OF THE VERTEBRÆ.*

(*Luxatio Vertebrarum*, Lat.; *Verrenkung der Wirbelbeine*, Germ.; *Luxation de la Colonne Vertébrale*, Fr.)

1008. The connexion of the *first vertebra* with the *occipital bone* is so firm, partly from the ligaments, partly from the muscles, partly from the condition of the joint-surfaces, that a dislocation at the junction of the first *vertebra* with the head (*Luxatio capitis, nuchæ*) cannot well be produced, and if it be so by extraordinarily great violence, it is absolutely fatal from the simultaneous injury of the spinal marrow.

(*a*) Recherches sur les Luxations Congénitales. Paris, 1841.

(*b*) Dublin Journal of Medical Science. May, 1842.

* The subjects Fractures and Dislocations of the *Vertebræ* are so closely connected, that it is almost impossible to separate them; and I have therefore already preferred considering them together under the former title (p. 531, and following.)—J. F. S.

1009. The turning and movement of the head is, for the most part, effected by the connexion of the second with the first *vertebra*, by which the latter, with the head, moves round the tooth-like process of the former, as upon a pivot. In forcible bending of the head forwards, the ligament fastening it to the tooth-like process may be torn, so that that process drives directly into the spinal canal. This dislocation always requires very considerable violence, and is not very possible in adults, in which case there is previous fracture of the tooth-like process. In rotation of the head, the lateral ligaments of this process are stretched, and if this motion be carried to a dangerous extent, they may be torn, and the process carried beneath the transverse ligament of the first *vertebra* into the spinal canal. In children in whom the tooth-like process is still low, and the ligaments less firm, they may be torn by violence when the head is drawn directly upwards. The violent circumstances which can produce dislocation of the second *vertebra* are, a fall from a great height upon the head, a violent blow, or the fall of a heavy body on the nape, standing and turning about the head, and lifting up children by the head. By the intrusion of the tooth-like process into the spinal canal, pressure and tearing of the spinal marrow are produced, and help is impossible Cases, however, seem to be known, in which only the lateral ligaments of the tooth-like process have been torn by violence and the patient has lived in this state although the process was still held but by the transverse ligament (*a*).

1010. The connexion of the *last five neck vertebræ* allows the inclination of the neck forwards, to the side, and a rotatory motion, by which, if carried to a violent extent, the joint-surfaces of the oblique processes get free from contact, are pushed against each other, and cannot be returned to their natural position. Hitherto, this dislocation has been only known on one side, as a consequence of external violence or of strong twisting of the muscles. If at the same time there be severe pain at the seat of dislocation, the head turned towards the opposite side, and fixed in this position, the muscles which move the head are not spasmodically contracted, the spinous processes deviate from their natural position, from the seat of dislocation up to the head. WALTHER (*b*) has observed the simultaneous dislocation of both inferior oblique processess of one of the middle neck *vertebræ*, and from this case has given the symptoms of such dislocations. The head is turned back, and the neck so bent, that the original line forms a curve, of which the convexity is forwards and the concavity backwards, the front parts of the *vertebræ* are more separated, but the spinous processes at the same time are pushed one upon another. Such dislocation may, as WALTHER's case proves, happen without any dangerous effect on the spinal marrow; but there may occur with it, as well as with every other injury of the vertebral column, effects on the spinal marrow dangerous to life, as pressure, tearing, inflammation, and the like, and death may be immediate or soon consequent.

DUPUYTREN (*c*) guards against the possibility of confusing such dislocation with rheumatic affection of the neck, which, from some straining or violent motion of the head, often comes on with severe pain, impossibility of motion, and the head directed to one side, just as it may occur, under similar circumstances, at any part of the spine (as in the so-called crick in the neck.)

(*a*) DELPECH, Précis élémentaire, &c. vol. iii. p. 47.

(*b*) Ueber die Verrenkung der Halswirbel nach eigenen Beobactungen; in his Journal für Chirurgie und Augenheilkunde, vol. iii. pt. ii. p. 197.

LAWRENCE, W., On Dislocations of the Vertebræ; in Med.-Chir. Trans. vol. xiii. p. 387.

(*c*) De la Luxation des Vertèbres et des Maladies qui la simulent; in Leçons Orales, vol. i. p. 397.

1011. If the dislocation of an oblique process be left alone, the pain gradually subsides, and the patient has no other inconvenience than an unnatural position of the neck and restricted motion of the head. It is, therefore, held most advisable by some (DESAULT, BOYER, RICHERAND, and DUPUYTREN) to leave this dislocation alone, because in attempting to reduce it, the spinal marrow may easily be so torn as to cause sudden death *(a)*. This opinion is, however, grounded especially upon an imperfect reason, and various cases are known, in which the reduction of this dislocation has been followed with happy result. SEIFERT (*b*) has refuted the reasons against undertaking the reduction of this dislocation, and has frequently performed it successfully. The patient should be placed on a low seat, or sitting on the ground, and his shoulders firmly held back by an assistant. The Surgeon then grasps the head, with one hand beneath the chin and the other beneath the *occiput*, makes extension first in the direction of the dislocation, then in the longitudinal axis of the neck, and when this seems to have been sufficiently made, he twists the head strongly towards the dislocated side. Still the more pressing is the necessity for reduction in dislocation of both oblique processes of the neck *vertebræ*, and that this may be effected, with care, the observation of WALTHER proves. The patient is to be put in a horizontal position, held up by three assistants, one of whom makes counter-extension on the *pelvis*, a second draws the shoulders back, and when the trunk is thus properly fixed, a third assistant grasps the head and makes extension, first in the direction of the dislocation, afterwards in the natural longitudinal axis of the neck, that is, he first pulls the head pretty forcibly back by gradually lengthening the neck, and then turns it backwards. But when the extension in this direction has attained a certain extent, the head must be brought into its naturally straight position, by undiminished and still successively increasing extension.

GUÉRIN (*c*) reduced a seventh months' dislocation of the second *vertebra* of the neck upon the third.

1012. Dislocation of the oblique processes of the back *vertebræ* cannot happen, nor dislocation *of the bodies of neck-vertebræ*, on account of the breadth of their joint-surfaces, the quantity and thickness of their ligaments, the strength of the muscles surrounding them, and the slight motion with which each *vertebra* is endowed. Only when the bodies of the *vertebræ* are broken can they be dislocated; but then so great violence operates that symptoms of pressure and concussion of the spinal marrow accompany it. All the cases described as dislocations of the back and loin *vertebræ*, are fractures of those bones, or simple concussion, or some other injury of the spinal marrow. In consequence of the form and connexions of the bodies of the *vertebræ*, every dislocation must cause death.

DUPUYTREN has collected several cases in which dislocation was accompanied with fracture; in one case separation of the bodies of the *vertebræ* occurred from tearing of the intervertebral substance, without any fracture. In all these cases death followed the simultaneous injury of the spinal marrow.

From what has been said, it may be collected, how those cases are to be thought of, in which, with some projection observable after the operation of violence upon the spine, the patient cannot sit upright, and so on, it has been supposed that by laying the body over a tub or any round body, the common dislocation could be reduced. BOYER has also observed on this point, that in violent bending of the spine, the upper and

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(*a*) PETIT-RADEL, Dictionnaire de Chirurgie; in Encyclopédie Méthodique.

(*b*) Ueber die prognostische Bedentung therapeutische Behandlung der Halswirbel verrenkungen; in RUST's Magazin, vol. xxxiv. p. 419.

(*c*) Révue Médicale, August, 1840, p. 276.

interspinous ligaments of the spinous processes, and the hinder so-called yellow ligaments may be torn. If the tearing be confined to the interspinous and to the upper ligaments, the patient may recover after a longer or shorter period of rest; but tearing of the yellow ligaments causes palsy and death (*a*).

1013. The ligaments of single *vertebræ* may be partially or completely torn through, without dislocation, but the injury of the spinal marrow therewith connected may cause death suddenly or subsequently; and to such cases all that has been said in relation to fractures of the spine applies. In every case of distortion and tearing of the ligaments of the spine, only a strict antiphlogistic treatment, with continual rest, and subsequently, frequent purgatives to prevent the destructive subsequent diseases, may be employed.

III.—OF DISLOCATION OF THE PELVIC BONES.

(*Luxatio Ossium Pelvis*, Lat.; *Verrenkung der Beckenknochen*, Germ.; *Luxation des Os du Bassin*, Fr.)

Creve, Von den Krankheiten des weiblichen Beckens. Berlin, 1795. 4to. p. 137.

1014. The broad surfaces of the articulations of the pelvic bones, and the great strength of their ligaments, render their separation impossible under natural circumstances, except when acted upon by extraordinarily great violence. The rump-bone may be dislocated *inwards*, and the hip-bone, *upwards*. These dislocations are never complete; the effects of violence, however, usually act upon the intestines of the pelvic cavity and upon the spinal marrow, and inflammation and tearing of these intestines and effusion of blood, and so on, in the pelvic cavity, ensue; also, palsy of the lower limbs, of the bladder, and *rectum;* and not unfrequently is fracture of the pelvic bones present.

The treatment of these dangerous injuries must be precisely the same as has been mentioned (*par.* 615) for fractures of the pelvic bones.

One case shows that a dislocation of the hip-bone upwards may be produced by a fall from a great height, without symptoms of concussion of the spinal marrow or injury of the pelvic intestines. The share-bone and the spine of the hip-bone of the left side were higher; the left limb was shorter than the other, but the distance from the *trochanter* to the spine of the hip-bone and to the knee, was the same as on the other side; flexion and extension of the thigh were accompanied with severe pain in the *symphysis pubis* and *sacro-iliaca*, with which frequently the whole hip-bone moved. The extension caused only severe pain, without bringing the limb to its natural length. The treatment in this case consisted in strict quiet, and the employment of proper antiphlogistic remedies. When the patient began to walk, he gradually, by the weight of his body, recovered the proper position of the hip-bone (*b*).

1015. Great as must be the violence to produce a separation of the hip-bone, if its articular connexions have their natural degree of strength, just as easily can it be produced if these connexions be lax and yielding. Such is the case in loosening and swelling of the ligaments of the pelvis during pregnancy. Wherefore also frequently from the extension which these bones suffer during delivery, or if the woman get about soon after her downlying, a pretty smart pain is suffered in one or both joints of the pelvic bones, which recurs at every movement, and is accompanied at first with the sensation of a tearing, and subsequently, distinct crepitation is felt in the pelvic joints. The gait of the patient is then difficult, and on

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(*a*) Boyer, p. 121.

(*b*) Ibid, p. 135.

examination, the position of the two hip-bones is not found alike, the one being more or less high than the other.

A similar swelling, loosening and laxity of the joint ligaments of the pelvic bones often arises from an internal diseased condition, in which slight violence is sufficient to produce a separation of the pelvic bones.

1016. The principal indication in these cases is, to fix the *pelvis* as steadily as possible and prevent every movement; for which purpose, a belly bandage, or a leathern girdle, is to be applied sufficiently tight around the hips; by this the pain is often instantaneously got rid of, and the patient's movements much improved. How far the laxity of the ligaments, depending on general causes, may be relieved by friction, purging, and the like, must depend on the circumstances of the individual case.

1017. The *coccyx* may by violence be driven inwards, or by difficult labour be thrust outwards, giving rise to fixed pain, increased by motion of the lower limbs, but especially in going to stool; frequently it becomes severe and pulsating, when suppuration takes place. The ligaments are not torn in this so-called dislocation of the *coccyx*, it therefore recovers its natural position; the employment of the hand for its replacement, by the introduction of the finger into the *rectum*, or by its application externally is therefore superfluous. The treatment consists merely in rest, antiphlogistic treatment, and the local application of remedies to effect dispersion and get rid of the inflammatory symptoms. If suppuration take place, a speedy outlet must be afforded to the pus, or otherwise considerable destruction of the loose cellular tissue is produced.

IV.—OF DISLOCATION OF THE RIBS AND THEIR CARTILAGES.

(*Luxatio Costarum, earumque Cartilaginum*, Lat.; *Verrenkung der Rippen und ihrer Knorpel*, Germ.; *Luxation des Côtes et de leurs cartilages*, Fr.)

1018. Dislocations of the hinder end of the ribs have been totally denied by many writers, but admitted by others, who have mentioned a threefold kind of separation, *inwards*, *upwards*, and *downwards*, and complete and incomplete dislocation. So long as the examination of corpses had not shown the existence of these dislocations, it was doubtful whether the common dislocation were not fracture of the hinder end of the ribs; examination, however, has proved the possibility of the dislocation of the ribs.

B. Cooper (*a*) mentions a case of Webster's, in which a man who had died of fever, was, on dissection, found to have the head of the seventh rib drawn upon the front of the corresponding dorsal *vertebra* and anchylosed to it. Some years previously he had had a sudden and violent fall from his horse, for which the ordinary treatment of fractured ribs had been had recourse to. Donne (*b*) showed from the examination of the body of a child of eleven years old, a complete dislocation of the tenth, and a partial one of the eleventh rib; Fimicane one of the eleventh and twelfth rib; Hankel (*c*) a dislocation of the eleventh rib.

1019. Dislocation of the ribs is only produced by the direct operation of external violence. It occurs most frequently at the eleventh and twelfth ribs, because their front end has no point of support, the transverse process is less projecting, and the costo-transverse joint, together with the interosseous costo-transverse ligament are deficient. Dislocation of the rib may be distinguished by its greater mobility, when the finger is run along it, and which is still more perceptible the nearer it approaches

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(*a*) His Edition of A. Cooper's Dislocations, p. 520.

(*b*) Gazette Médicale de Paris, 1841, No. 26.

(*c*) Ib., 1834, p. 187.

the hinder end; by a particular rustling, (which is not to be confused with that from fractured rib or from emphysema,) which is perceived on the movements of the body and ribs by the practitioner, or by the patient himself; by a yielding of the parts covering the hinder end of the rib; by a depression where the head of the rib should be found, and by motion of the hind end on pressure of the front end. It is accompanied with cough, difficult respiration, severe pain, and other symptoms, as in fractured ribs (*par.* 627.)

1020. To effect *reduction*, the patient should be placed with his chest upon a firm pillow, so that the front end of the dislocated rib may be pressed backwards, and then the *vertebra* above and below the dislocation is to be pressed down. The rib must be kept in place, by a thick compress placed at the front end and upon the spinal column, and properly fastened with a chest bandage. If the object cannot be thus attained, it has even been advised to open the cavity of the chest, and with the finger or with a hook to bring the rib into its place. No one should be seduced to such a practice. It is most proper in every case to proceed, as in fracture of the ribs, to prevent the motions of the chest, with a broad bandage, and to counteract the other symptoms by proper means.

1021. The *cartilages* of the upper false and lower true ribs may be separated in violent bending backwards of the body, in which the ligaments are torn where the under cartilage overlaps the upper. At this part projection and depression are observed, the patient feels pain, and the breathing is somewhat disturbed. The natural position of the cartilage can be restored, if the patient inspire deeply and bends backwards, whilst some pressure is made on the projecting cartilage. The treatment is the same as in fracture of this cartilage (*par.* 629.)

Astley Cooper (*a*) has noticed dislocation of the cartilage most frequently at the sixth, seventh, and eighth rib, from the breast-bone and the end of the rib, not unfrequently in children, as consequent on general weakness.

V.—OF DISLOCATIONS OF THE COLLAR-BONE.

(*Luxatio Claviculæ*, Lat.; *Verrenkung des Schlüsselbeines*, Germ.; *Luxation de la Clavicule*, Fr.)

1022. *Dislocation of the Collar-bone* is much more rare than fracture, and may be of the *sternal end* or the *scapular end* of the bone.

1023. It is generally held that the *sternal end of the collar-bone* may be dislocated *forwards*, *backwards*, and *upwards*. In this dislocation, if the separation of the joint-surfaces be only rather considerable, the tendinous strengthening fibres, the interclavicular ligament, and perhaps frequently the fibres of the sterno-mastoid muscles seem to be torn.

In dislocation *forwards*, which is the most common, and depends on violent pressing backwards or inwards of the shoulders, a projection is observed on the fore and upper part of the breast-bone, which subsides when the shoulder is pressed outwards; the shoulder stands deeper and more inwards; the head is inclined towards the ailing side; the movement of the arm is interfered with and painful; if the shoulder be raised, the prominence subsides; if the shoulder be depressed, the prominence rises up towards the neck. The dislocation is frequently incomplete, the front only of the capsule being torn, and the bone but little projecting. In disloca-

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(*a*) Above cited, p. 537.

tion *upwards*, the distance between the two sternal ends of the collar-bones is diminished, and the dislocated end is higher than that of the opposite side. Dislocation *backwards*, the possibility of which is admitted by most persons, though by others in a manner doubted, but which has been proved by a case of Pellieux's (*a*), may be caused by violence which thrusts the shoulder forwards, or acts immediately upon the sternal end of the collar-bone from before backwards. Its symptoms are a depression in place of a projection, at the inner end of the collar-bone, only at the opposite end there is decided position and direction of the bone from within outwards, and from behind forwards, severe pain in the region of the collar-bone, and upon the whole side of the neck to the very base of the lower jaw, the mastoid process and occipital protuberance, on sudden movement of the arm, especially in certain opposition to overcome it, as well as with pressure of the hand; on motion, a dull rustling is perceptible to the patient, as of rubbing the two surfaces of the bone together; some pain on rotating the head, hence a degree of stiff neck, so that the head, neck, and chest move together if the patient look sideways; incapability of the patient raising himself from the bed, except by putting an object before him to serve as a point of resistance; lastly, slight pain in swallowing.

As the greater number of writers on this dislocation state that, in it, the wind-pipe and gullet, the vessels and nerves are compressed, and severe symptoms are thereby produced, neither of which was observed by Pellieux in his case, and the assumption of which depends only on a short notice of Duverney's (*b*), and a case related by Astley Cooper, in which dislocation in the second way occurred, therefore Pellieux gives a superficial and a deep dislocation of the sternal end of the collar-bone, taking for the former, the symptoms above described, but for the latter, which can scarcely occur but from direct severe violence upon the collar-bone, and with complete tearing away of the *m. sterno mastoideus*, the more important symptoms of pressure on the wind-pipe and gullet, and on the vessels and nerves of the neck. But this statement is unsupported by any reason; for in the case related by A. Cooper, (p. 401,) there occurred, during great curvature of the spine, a *gradual* dislocation of the sternal end of the clavicle backwards, in which, for the purpose of relieving the severe symptoms of impeded swallowing, the dislocated end of the collar-bone was removed.

[In September 1835, there was admitted into St. Thomas's Hospital, under Tyrrell, a case of compound dislocation of the collar-bone, backwards, which I saw. It had been caused by an earth slip of twelve feet in height, burying him, whilst employed in preparing for the Southampton railroad, and driving the sharp end of a pickaxe, with which he was working, into his chest. He reached the hospital three hours after the accident; and on examination, the cellular tissue below the right collar-bone and on the upper part of the breast-bone was found emphysematous. The collar-bone was distinctly dislocated backwards at its sternal end, and there was a wound in the skin opposite the junction of the second rib with its cartilage. When the finger was introduced into this aperture, the great pectoral muscle was found completely scraped from its clavicular attachment, and the finger could pass as far outwards as the coracoid process of the blade-bone, and inwards, it followed the collar-bone to the windpipe, on the right and fore-part of which it rested, slightly sunk behind the upper piece of the breast-bone, so that it somewhat interfered with respiration and deglutition. The interarticular cartilage seemed to remain in its proper place, except a small portion which had been torn off with the bone; the extreme inner end of the collar-bone could not, however, be distinctly felt; no wound of the intercostal muscles could be ascertained. The pickaxe had probably first passed upwards and outwards, then turned inwards, torn off the pectoral muscle from its origin, and having dislocated the bone, passed inwards above the breast-bone in those directions in which the finger could move; probably it had wounded the *pleura* and right lung, which appeared the only way of accounting for the emphysema. According to his own account, it would seem as if the handle of the tool had penetrated, for he says, the handle was standing upright and he fell forward

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(*a*) Mémoire sur la Luxation de l'extrémité sternale de la Clavicule en arrière; in Révue Médicale, 1834, August, p. 161.

(*b*) Traité des Maladies des Os, vol. i. p. 201.

upon it. But I doubt the correctness of this, as the skin wound was not more than two inches long, and beneath it my little finger would just enter, and no room to spare. He complains of a little pain opposite the middle of the second piece of the breast-bone; but he has not any other pain in his chest, and no fracture can be discovered. He seems to breathe easily, although he complains of difficulty of breathing, accompanied with great desire to cough, and a sensation of pressure on the windpipe, which is much increased on raising the skin of the neck when he throws his head back.

The shoulder having been brought back with straps attached to a back-board, the bone readily resumed its place. The elbow was brought forward and bound to the side. The wound was dressed with sticking plaster, and he was put to bed with the shoulders much raised. He went on without the least unfavourable symptom; in three weeks left his bed, and three weeks after went out of the house. The sternal end of the collar-bone still fell a little backwards, and was a little more movable than natural. He was warned not to use his arm violently.

In September, 1839, Velpeau (*a*) had under his care a case of simple dislocation of the sternal end of the collar-bone inwards and backwards. The man had been violently squeezed between the wall and a cart, " in such a manner as to thrust the left shoulder forcibly inwards, and break up the ligaments which connected the clavicle of the same side to the first bone of the *sternum;* in this way the sternal end of the left clavicle lay upon the superior edge of the *sternum*, behind the sternal attachment of the sterno-mastoid muscle. The articulating surface of the bone lay close to the junction of the *sternum* with the clavicle of the opposite side. Velpeau considered that in the first instance the force producing the dislocation had operated, so as to displace the sternal extremity of the clavicle upwards and backwards, inasmuch as the bone lay behind the sternal portion of the sterno-mastoid muscle, and that it was after this had been effected, that the displacement inwards and across the upper part of the *sternum* occurred. He considered this was the first instance of this kind of displacement of the sternal extremity of the clavicle which had been observed; in which opinion, however, he was wrong, as the case just mentioned proves.—J. F. S.]

1024. The *reduction* of the dislocated sternal end of the collar-bone is easy; with one hand the elbow is fixed, and with the other placed on the upper part of the humerus, the shoulder is drawn outwards and backwards, as in treating fracture of the collar-bone (*par.* 639.) In dislocation forwards, the shoulder should be pressed forwards, in that backwards, backwards, and in the upward dislocation upwards, so as to prevent the slipping out again of the end of the bone; and the arm is to be kept in proper position with the apparatus already mentioned for fractured collar-bone. According as this apparatus is more or less relaxed, there commonly remains greater or less deformity at the sternal end of the bone, which, however, has no effect upon the motions of the arm.

Melier's apparatus, in dislocation of the collar-bone forwards, in which a compress similar to a truss, and pressing on the projecting end of the bone, is connected with Desault's apparatus (*b*).

[It will not be out of place to mention here, the operation performed by Davie, of Bungay, on the case of backwardly dislocated sternal end of the collar-bone referred to by Astley Cooper, in which the bone pressed so upon the *œsophagus* as to occasion extreme difficulty in swallowing. " An incision was made of from two to three inches in extent on the sternal extremity of the clavicle, in a line with the axis of that bone; and its surrounding ligamentous connexions, as far as he could reach them, were divided with the saw of Scultetus (often called Hey's); he then sawed through the end of the bone, one inch from its articular surface from the *sternum*, and fearful of doing unnecessary injury with the saw, he introduced a piece of well-beaten sole-leather under the bone whilst he divided it. When the sawing was completed he tried to detach the bone, but it still remained connected by its interclavicular ligament, and he was obliged to tear through that ligament by using the handle of the knife as an elevator, and after some time succeeded in removing the portion of bone which he had separated." The case did well (*c*).]

(*a*) Lancet, 1839-40. vol. i. p. 422.

(*b*) Archives générales de Médecine, Jan. 1829, p. 53.—Froriep's chirurgische Kupertafeln, pl. ccxxvii.

(*c*) A. Cooper, above cited, p. 402.

1025. The scapular end of the collar-bone can only be dislocated *upwards*, (extremely seldom *downwards* beneath the *acromion*,) and the separation of the two articular surfaces is not great. The cause is generally a severe fall upon the shoulder, by which it is violently turned backwards. The signs of this dislocation are pain on the top of the shoulder, depression of the shoulder, a great space between the *acromion* and scapular end of the collar-bone, or a projection of the latter; unaccustomed motion of these two parts, impeded motion of the arm, especially in elevation, diminished distance of the shoulder from the chest, disappearance of the prominence when the shoulders are drawn backwards, but which reappears when it is let go; and if the finger be carried forward upon the spine of the blade-bone it is stopped by the projecting end of the collar-bone.

It has been hitherto assumed that the acromial end of the collar-bone can only be dislocated upwards; at least, experience knew no other kind. TOURNEL (*a*), however, saw a case in which the weight of a horse, in a sudden fall, caused separation and driving back of the blade-bone, the collar-bone still remaining fixed at its sternal end, but its outer end, from which the inferior and coraco-clavicular ligaments were torn, was separated from both articular surfaces, and slipped beneath the *acromion*. The pivot motions of the arm could be made in the usual directions; the left arm was somewhat longer than the right, the elbow and upper part of the arm lay against the side of the trunk; the voluntary motions, especially those upwards, were impossible, the patient could not bring his hand to his head; the communicated motions were free and painless; the shoulder had lost its rounded form, and below the *acromion* externally was a deep hollow. The shoulder had also two prominences, an internal and upper, formed by the *acromion*, and an external under by the lower end of the collar-bone. Neither numbness of the fingers nor pain were present; the point of the left shoulder was much nearer the breast-bone than the right; when the finger was carried along the spine of the blade-bone from behind forwards to the *acromion* it was stopped by the projection of the collar-bone. This was perfectly discernible, and disappeared, as well also as the hollow beneath the *acromion*, when the shoulders were drawn back, the knee being placed between them; but so soon as this was left off, the projection formed by the end of the collar-bones and the depression beneath the *acromion* reappeared. With DESAULT's apparatus, and subsequently with that of FLAMMANT, a cure was effected without deformity, and without restriction of the motions of the arm. MELLE (*b*) examined after death, and described such a dislocation of the outer end of the collar-bone downwards.

1026. This dislocation is always easily reduced; the arm is to be raised up against the collar-bone, the scapular end of which is to be depressed. DESAULT's apparatus for fractured collar-bone is applicable, with the alteration of putting a thick compress upon the scapular end of the collar-bone, and the turns of the bandage which are carried over the injured shoulder and the elbow, to be sufficiently tightened, and further, the arm to be also fixed to the breast with a bandage. The first days the injured parts are to be moistened with cold dispersing applications. As often as the bandage becomes loose it must be tightened. In from four to six weeks it may be removed; most commonly there remains greater or less displacement, which, however, does not interfere with the motions of the shoulder.

[The dislocation of the collar-bone upon the spine of the blade-bone is one of the most tiresome accidents we have to do with; at least in all the cases I have had to deal with, and the injury is not unfrequent, I have never been able by any contrivance to keep it in place, and have therefore given up attempting to keep it reduced, and only endeavour to keep it at rest, so that it may form new connexions on the scapular spine.—J. F. S.]

(*a*) Archives générales de Médecine, 1837, December.

(*b*) Nova Acta physico-medica, 1773, vol. v. p. 1.

VI.—OF DISLOCATION OF THE UPPER-ARM.

(*Luxatio Humeri*, Lat.; *Verrenkung des Oberarmes*, Germ.; *Luxation du Bras*, Fr.)

Bonn, Abhandlung von Verrenkungen des Oberarmes. Leipzig, 1783.

Desault, above cited.

Warnecke, Abhandlung über die Verrenkung des Oberarmes aus dem Schultergelenke und deren Heilart. Nurenberg, 1810; with plates.

Boyer, above cited, p. 174.

Mothe, Mélanges de Chirurgie et de Médecine. Paris, 1812.

Busch, Dissert. de Luxatione Humeri. Berlin. 1817.

Dupuytren, De la différence dans le Diagnostic des Luxations et des Fractures de l'extrémité supérieure de l'Humerus; in Répertoire Général d'Anatomie et de Physiologie Pathologique, vol. vi. part iii. p. 165.

Malgaigne, Luxations de l'Articulation Scapulo-humérale; in Journal des Progrès des Sciences et des Institutions Médicales, vol. iii. Paris, 1830.

Cooper, Astley, above cited, p. 415.

Crampton, Philip, M.D., On the Pathology of Dislocation of the Shoulder-Joint; in Dublin Journal of Medical and Chemical Science, vol. iii. p. 42. 1833.

1027. The free motions of the shoulder, the great misproportion between the size of the head of the upper-arm-bone and the flattened hollow of the joint-surface of the blade-bone, the slight strength of the capsule of the joint, and the frequent operation of external violence upon the shoulder-joint, render the *dislocation of the upper-arm* more frequent than that of any other bone.

1028. The head of the upper-arm-bone may be displaced in three different directions:

1, ~~*Upward*~~*s* (and *inwards*); the head of the bone rests on the front edge of the blade-bone, between the insides of the long heads of the *m. triceps* and the *m. subscapularis.*

2, *Inwards;* the head of the bone recedes between the subscapular pit and the muscle of the same name, beneath the *m. pectoralis major.*

3, *Outwards;* between the infra-spinate pit and muscle. [This is the dislocation *backwards* of English Surgeons.—J. F. S.]

The dislocation downwards is the most common, that inwards more rare, and that outwards the rarest. The dislocation upwards is impossible, partly on account of the acromial process, and the firmness of the joints especially, partly because the upper-arm cannot, on account of the trunk, be driven inwards as much as necessary in order to dislocate it upwards.

Astley Cooper (*a*) speaks of a fourth partial dislocation, when the front of the capsular ligament is torn, frequently only stretched, and the head rests against and on the outer side of the coracoid process of the blade-bone (*b*).

1029. If the head of the upper-arm-bone be dislocated *downwards*, it may be drawn inwards by the contraction of the muscles, (but the *m. triceps extensor* prevents it being pulled outwards,) and thence gradually upwards towards the collar-bone. In the dislocation *outwards* such consecutive displacement towards the spine of the blade-bone is not possible. In dislocation of the upper-arm-bone, there may be therefore a fourfold varying position of the head of the bone: 1, *downwards;* 2, *outwards*, always primitive; 3, *inwards*, frequently primitive, usually consecutive, and, 4, *inwards* and *upwards*, constantly as consecutive dislocation. A. **Cooper**,

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(*a*) Above cited, p. 446.

(*b*) **Dupuytren**, Leçons Orales, vol iii. p. 105. —**Hargrave, W.**; in Edinburgh Medical and Surgical Journal, October, 1837.

however, does not think that the head is dislocated consecutively, when the muscles have once contracted and no great violence operates.

Less change of position may originate in the absorption arising from pressure.

Opinions vary in reference to the primitive direction of dislocation of the upper arm. Many (HIPPOCRATES, DUVERNEY, FABRICIUS AB AQUAPENDENTE, DESAULT, MURSINNA, RICHERAND, MOTHE, and others) admit only the dislocation *downwards* as primitive, and that inwards and outwards as secondary. Others (VELPEAU, MALGAIGNE) determine only two primitive dislocations, namely forwards and inwards, and backwards and outwards.

1030. The several kinds of dislocation of the upper-arm are characterized by the following symptoms:

In dislocation *downwards*, the arm is rather longer, can be moved only a little outwards, and motion in any other direction causes severe pain; in old persons, however, the laxity of the muscles often permits more extensive motion; the elbow stands out from the trunk; the patient inclines himself towards the side of the dislocation, holds the arm half-bent, and supports his elbow on his hip. Beneath the *acromion*, which seems more prominent, a hollow is observed, the joint has lost its roundness, the middle line of the arm is directed towards the arm-pit in which is felt a globular protuberance, formed by the displaced head of the bone, only however when the arm is separated from the trunk. A kind of crackling is frequently noticed on motion, depending on the exuded matter, or on the effusion of *synovia*, which disappears on continuance of motion, and is never so great as in fracture. The pressure of the head of the bone upon the axillary *plexus* often causes loss of sensation, and the sensation of being asleep in the fingers.

In dislocation *inwards*, the elbow stands out from the trunk, and is inclined a little backwards; the direction of the arm corresponds to the middle of the collar-bone, the movement of the arm backwards is not very painful, but forwards extremely so. Beneath the great pectoral muscle is felt the protuberance of the head; the arm has either its natural length or is rather shorter; the flattening of the shoulder is observed especially at its hinder part; the fore-arm is not half bent.

In dislocation *outwards*, the arm is inclined inwards and forwards, the flattening of the shoulder is most distinct in front; the head of the bone forms a prominence in the infra-spinate pit; the arm may be moved forwards with the least pain, but every other movement is in the highest degree painful.

In imperfect dislocation, where the head is inclined forwards against the coracoid process, a hollow is observed opposite the back of the shoulder-joint and the hinder half of the glenoid cavity is perceptible; the axis of the arm is inwards and forwards; the under motions of the limb may be completely performed, but the arm cannot be raised, because the upper-arm is thrust against the coracoid process of the blade-bone; the head forms a distinct protuberance, and if the arm be rotated, the rolling motion of the head is felt.

It is very difficult, and generally impossible, in dislocation of the upper-arm, to determine whether the dislocation of the head of the bone inwards, be primary or consecutive; but inquiry as to how the symptoms have followed each other, and even the treatment in setting, may perhaps afford some clue.

1031. Dislocations of the upper-arm are produced by violence, which strikes the arm, and happens only on that particular direction of the arm, at the moment when the violence acts, according to which side the head of the bone is driven against the capsule and dislocated. In the occurrence of dislocation downwards, the contraction of the *m. pectoralis major*, *latissimus dorsi* and *teres major* especially participate. It, however, particularly depends on the *m. deltoides*, as shown by examples when this dislocation has happened in raising a heavy load.

The destruction of the soft parts in dislocation of the upper-arm, is for the most part restricted to the tearing of the capsular ligament to a tolerable extent and the bruising of the neighbouring parts. In dislocation inwards, however, a tearing of the *m. subscapularis* has been observed; as also oftentimes palsy of the arm, œdematous swelling of it; or a palsy of the deltoid muscle is connected with, or subsequently ensues on dislocation. Fracture of the neck of the upper-arm-bone has also been noticed simultaneously with this dislocation.

1032. The inflammatory symptoms which occur in dislocation of the upper-arm, are usually of little consequence, if reduction be soon effected; but if the dislocation be left alone, considerable interference with the movements of the arm occurs; the dislocated head is kept fixed in its position, the motions of the arm depend only upon the mobility of the blade-bone, and often after from four to eight weeks, reduction is no longer possible, even with the greatest efforts.

1033. In *reducing* dislocation of the upper-arm, the shoulder must be well fixed, the arm extended to a proper degree, and its head brought back in the same way in which it was dislocated. The patient should sit on a common seat, (in difficult cases it is advantageous to lay him horizontally on a couch,) a folded cloth is to be applied above the wrist, its two ends tied and given to an assistant. An oblong, tolerably thick bolster should be put into the arm-pit, projecting beyond the edges of the great muscles of the breast and back, and over it a folded cloth, the ends of which are to be carried over the front and back of the chest, to the sound shoulder, there tied, and given to an assistant. For the more complete fixing of the shoulder-blade, a second cloth is applied, with its middle on the *acromion*, its ends carried obliquely forwards and backwards, towards the other side of the chest, and given to an assistant, who draws them properly in this direction towards him. Or the shoulder is fixed by a proper bandage, (*retractor*,) through the opening of which the arm is passed (*a*). The Surgeon stands on the outside of the limb, and directs the assistants as to the direction and commencement of the extension.

In the dislocation downwards, extension must be made directly outwards, and when carried to a proper extent, the arm must be pulled downwards, and somewhat forwards till it be applied to the side of the body, when the Surgeon rests his body against the elbow, and with both his hands applied, the one on the upper, and the other on the under surface of the upper arm, carries the head back into the socket.

In dislocation inwards the extension must be made outwards and backwards, the arm brought forwards and downwards, till it lie obliquely across the front of the breast, and the Surgeon then assists the return of the head of the bone, by placing one hand upon the elbow and the other on the inside of the arm, and pressing the head outwards.

The dislocation outwards requires extension in the opposite direction to the preceding (*a*).

(*a*) Proper retractors are described by Pitschel (Anatom. und chirurg. Anmerkungen. Dresden, 1784, p. 66); by Mennel (Loder's Journal, vol. iii. p. 300); by Eckoldt (Köhler's Anleitung zum Verbande. Leipz, 1796, p. 299. Pl. viii. fig. 8, 9); by Schneider (Loder's Journal, vol. ii. p. 466); and by Astley Cooper.

In reduction the following points are to be especially noticed. As every dislocation of the upper arm occurs only in a certain position, so must its extension also be made in a corresponding position, and according to the directions laid down. In this position the *m. deltoides*, *supra-spinatus* and *infra-spinatus*, which mostly oppose the reduction, are rendered lax. On this account the dislocation is often reduced with ease, immediately after its occurrence, by raising the arm to the horizontal posture, and placing the fingers in the arm-pit. The arm is not to be brought into its natural position, till the head of the bone has been restored to the place from which it has slipped. The head is usually carried back into the socket, rather by the action of the muscles, than by any force applied to it. By what has been said is explained the fitness of La Mothe's (*a*) proposed mode of reduction. The patient is to be placed on a seat; the shoulder to be fixed by means of a cloth, folded lengthways, applied over it, and held by two assistants sitting on the ground; a third, standing on the uninjured side, draws horizontally a cloth laid round the chest. The Surgeon, standing on a table near the patient, grips the dislocated arm with both hands, raises it, gently drawing it up towards the patient's head, then pulls more forcibly, and thus almost without pain causes the head of the bone to rise up into its place. Rust (*b*) simplifies this treatment; the patient being seated on the ground, on a carpet or flat cushion, an assistant, kneeling on the side opposite the dislocated arm, grasps the injured shoulder with both hands locked in each other, the one of his arms being carried before, and the other behind the patient. Whilst he draws the shoulder strongly and steadily downwards, the Surgeon, standing on the same side as the dislocated arm, grasps it with both hands at the wrist and fore-arm, draws it somewhat towards him, in order to keep it constantly extended, and raises it, by a circular movement, above the head of the patient, so that the upraised arm is brought parallel with the long axis of the body. The Surgeon then draws the arm strongly towards him, as if he would raise the patient from the ground, and at the moment this is effected, the head of the bone slips back into its socket. If this do not happen, the Surgeon may now give the extension of the arm to an assistant, and kneeling by the patient, places both thumbs under the protruded head, and leads it, by pressing upwards, into its socket. He then fixes one thumb firmly in the arm-pit, with the other hand grasps the elevated arm above the elbow-joint, and draws it carefully down, when, if the head of the bone be not completely carried into its socket, its complete reduction must be attempted, by more firmly sliding it over the opposed thumbs, as if over a roller.

1034. Complete reduction is characterized by the natural form of the joint, the cessation of pain, and the free movement of the arm in every direction. To counteract the disposition which the upper-arm always has to become dislocated afresh, its motions should be prevented; the arm is to be put in a sling, or fastened with some circular turns of a bandage round the body, and some may be carried beneath the elbow and over the shoulder. For the first few days cold applications are to be applied over the shoulder to remove the bruising. If a paralytic state of the arm continue, (which there is always ground to fear if after the dislocation there ensue a sensation of cold, of going to sleep, and weight,) stimulating friction, douche-baths, blisters, moxas, and the like must be employed. This may arise also from palsy of the deltoid muscle.

1035. In this way the dislocation of the upper-arm-bone may ordinarily again be put to rights. If violent contraction of the muscles occur, we must attempt to diminish it by the remedies heretofore mentioned. A small opening in the capsular ligament is mentioned by many, as the obstacle to reduction in several cases, which may be imagined if the head of the bone return to its place without noise and be directly again dislocated; in such case the aperture of the capsular ligament must be attempted to be enlarged by moving the arm; numerous observations, however, oppose this notion.

(*a*) Busch, above cited.

(*b*) Rust, in his Magazin für die gesammte Heilkunde, vol. x. p. 184.—Leonhardt, F., Dissert. de Methodo Mothiano humerum luxationi reponendi. Berlin, 1820. 8vo.

1036. Besides the modes of reducing dislocations of the upper-arm already given, the following still require to be mentioned:—

1. In recent dislocation the patient may be laid on his back upon a table or sofa, in such way that the affected arm may be completely on the edge; a wetted roller is to be applied on the arm above the elbow, and over this a handkerchief is to be fastened. The Surgeon, standing with one foot on the ground, places the heel of the other in the patient's arm-pit, so that he finds himself in a half-sitting posture by the side of the patient. By means of the handkerchief he extends the arm for three or four minutes, in which way, under ordinary circumstances, the head is easily reduced. If more power be required, a towel instead of a handkerchief should be fastened around the arm, by which several persons may pull, whilst the heel is still in the arm-pit. In order to relax the *m. biceps* the fore-arm must be bent. In this mode of reduction there is less extension of the limb than lateral separation of the head of the arm-bone from the blade-bone. On this account probably has BERTRANDI (*a*) proposed, that the Surgeon should place himself between the legs of the patient as he lies in bed, and make use of his left foot if the dislocation be on the right, and his right foot if it be on the left side. SAUTER's (*b*) treatment corresponds to this; the patient being placed on a seat, the dislocated arm is to be drawn down perpendicularly on the body, fixed in this direction by the one hand of the Surgeon at the elbow-joint, and drawn towards the ground, whilst with the other hand the head of the bone is thrust upwards; at the same time an assistant may further the extension, by drawing down the hand, but which is not always, nor ever with violence, to be done. In dislocation inwards the arm is to be inclined more forwards.

2. The patient, being seated on a low stool, the Surgeon separates the dislocated arm so far from the body, that he can put his knee into the arm-pit, and whilst he places his foot by the side of the stool, he puts one hand upon the arm-bone, immediately above the condyles, and the other upon the *acromion*, then presses the arm downwards over the knee, and in this way reduces the dislocation (*c*).

1037. If in very powerful persons, or in old dislocations, these modes of treatment be unsuccessful, and it be necessary to overcome the muscles by *continued* and *gradually increased extension*, the pulleys are to be employed as most convenient. The patient is to be put on a stool, the shoulder fixed with a retractor, and this attached to a hook fixed in the wall on the patient's sound side; the extension-bandage is to be put on above the elbow, and, by other bandages connected with the pulley, fastened to the other wall. The direction of the extension is to be similar to that made by assistants; and it must be made gradually, if intended to be kept up for some time. When it has attained sufficient degree, the Surgeon puts his knee in the arm-pit, places his foot on the stool, and raising the head of the bone, thrusts it gently into the socket, which, at the moment when the extension is left off, usually happens without any snap.

The various contrivances proposed for reducing dislocation of the upper-arm are in part superfluous, in part unsuitable, because the mechanical violence acts too much on the head of the bone itself; or the extension cannot be made after every one's favourite direction. To these contrivances belong the ambe of HIPPOCRATES, the machines of

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(*a*) Institutiones Chirurgicæ, vol. v.

(*b*) Ueber die Einrichtung des verrenkten Achselgelenkes; in HUFELAND's Journal, vol. xliii. pt. i. July, 1816, p. 39.

(*c*) ASTLEY COOPER, p. 432.

Oribasius, Paré, Gersdorff, Scultetus, Purmann, Petit; the reductors of Ravaton, Hagen, Freck, Mennel, Schneider, Brunninghausen, and others.

1038. If the dislocation have existed some weeks, the arm must, previous to extension, be moved forcibly in every direction, for the purpose of loosening it, and the relaxation of the muscles must be effected by the means already mentioned. After the reduction of these old dislocations, an emphysematous swelling is often observed beneath the great pectoral muscle, which soon disappears under the use of dispersing remedies. Weinhold cut through the tendon of the *m. pectoralis major*, because it did not yield in an old dislocation (*a*). The dislocations at the shoulder-joint may often be satisfactorily reduced, even after a long time, especially in relaxed persons; the attempt at reduction, however, is not to be carried too far, as dangerous symptoms may ensue (*b*).

Gibson noticed a rupture of the axillary artery in reducing an old dislocation.

Dieffenbach (*c*), whilst making extension and counter-extension in the usual manner, in a dislocation of two years' standing, divided the tendons of the *m. pectoralis major* and *latissimus dorsi*, the *m. teres major* and *minor*, beneath the skin, and the false ligaments surrounding the new joint, upon which, with the extension made, the head suddenly returned into its socket, and he then applied over it a pasteboard apparatus.

1039. The *Congenital* Dislocation *of the Upper-Arm-bone* (*Luxatio congenita Humeri*) does not, according to R. W. Smith (*d*), who first noticed it, happen so very rarely. In the early period of life, before the more perfect development of the bones, and before the more powerful action of the muscles, the external appearance of deformity may possibly escape observation; but when the shoulder-bones have attained to their perfect development, when the bony processes about the joints project, and especially when the muscles operating on the shoulder-joint and upper-arm acquire their full activity, then first are the characteristic marks of congenital dislocation not easy to be mistaken. Smith has noticed two kinds of congenital dislocation, viz., the *subcoracoid* and the *subacromial* dislocation.

1040. In the *congenital subcoracoid* dislocation, the head of the upper-arm-bone, when the arm hangs down on the side, is situated beneath the coracoid process, and the outer part of the glenoid cavity can be felt beneath the projecting *acromion;* if the elbow be drawn forward over the chest, the head of the upper-arm-bone slips backwards over the *acromion*, and completely leaves the unnatural part of the articular surface, which can now be distinctly felt; the shoulder has not its natural rounded form, but is flattened. The muscles of the shoulder and arm are much shrunk, and also the muscles passing from the chest to the blade-bone and upper-arm, only the *m. trapezius* shows the least of this, and seems to be almost the only muscle, which still acts upon and moves the blade-bone; the diseased arm is nearly half an inch shorter. The motions of the arm are very much restricted; elevation and abduction are not possible, and even the forward and backward motions cannot be performed without corresponding movement of the blade-bone. Although the muscles of the forearm are not so much shrunk as those of the upper, yet flexion is so diffi-

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(*a*) Zwanzig de Luxatione Ossis Humeri, et precipuè Incisione Aponeuroseos Musculi Pectoralis Majoris ad cur. Luxat. inveter. Halæ, 1819.

(*b*) Flaubert, Mémoire sur plusieurs cas de Luxation, dans lesquels les efforts ont été suivi d'accidens graves; in Répert. gén. d'Anatomie et de Physiologie Pathologique, vol. iii. fasc. i.

(*c*) Vereinszeitung, 1839, No. 51.

(*d*) An Essay upon the original or congenital Luxations of the upper extremity of the Humerus; in Dublin Journal, vol. xv. p. 236.

Froriep's N. Notizen, July, 1839. No. 225 and 227.

cult, on account of the atrophy of the *m. biceps*, that it can scarcely be brought to a right angle. Elevation is not performed gradually, but with a sudden jerk, in which the blade-bone also is considerably raised, the arm pressed to the side, and sometimes even the body bent to the other side, whilst the elbow-joint rests upon the crest of the hip-bone. The deformity exists from birth, but only first at the period of perfect development does it become more apparent. This congenital dislocation may exist on both sides at once.

1041. Examination after death of a case of subcoracoid dislocation on both sides, showed upon the one side scarcely a trace of the natural socket, but, on the contrary, immediately beneath the lower edge of the coracoid process, partially upon the ribs, partially on the axillary edge of the blade-bone, a well-formed socket of an inch and a-half diameter; this reached to the under surface of this process, and was only separated from the upper-arm by the capsule of the joint. The perfectly formed capsular ligament, extending from the undeveloped glenoid cavity, surrounded these articular surfaces. The perfectly natural tendon of the *m. biceps* arose from the point of the latter, and the capsular ligament was also quite natural. The head of the upper-arm-bone varied considerably from its rounded form; it was oval, and its long axis corresponded with that of the bone itself, which depended especially on the hinder part being deficient. The shaft was small and decidedly atrophic; the position of the head on the coracoid process varied, according to the rotation of the arm inwards or outwards. Upon the other side the deficiency of the articular surface was confined to its inner edge, which was entirely wanting for a thumb's space from above downwards. The inner edge of the joint-surface was formed by a long ridge, which passed down from the under surface of the coracoid process; the tendon of the *m. biceps* and the capsule were perfectly formed.

1042. SMITH saw and examined after death *congenital subacromial* dislocation on both sides. The coracoid process projected considerably, as did also the *acromion;* the joint-surface beneath was not, however, to be felt; the projection of the *acromion*, as well as the flattening of the shoulder, was less decided than in subcoracoid dislocation; the flattening was confined to the front of the joint. The head of the upper-arm-bone formed a distinct swelling on the back of the blade-bone, beneath and behind the point of the *acromion*, close on the under surface of its spine. The upper-arm did not stick out from the side, and the fore-arm was rotated inwards. Internal examination of the joint presented no trace of an articular cavity in the usual place, but a well-formed articular pit, surrounded by a capsular ligament, arising from the outer surface of the neck of the blade-bone, which was broader above, and completely reached the under surface of the *acromion;* the tendon of the *m. biceps* was perfect, and firmly attached to the upper and inner part of the unnatural joint's surface, the direction of which was forwards and outwards. The head of the upper-arm-bone exhibited the same oval form as in the subcoracoid dislocation, only that the fore part of the head was in this case deficient. The little tubercle formed a considerable projection, long and curved, so that it had remarkable resemblance to the coracoid process of the blade-bone.

1043. That these dislocations are *congenital* and *not of accidental occurrence*, SMITH thinks he has found proof of, as regards subcoracoid dislocation, in the absence of previous injury, in the joint not being the seat of pain, swelling, and the like, but especially in the unhurt condition of the capsule and of the tendon of the *m. biceps*, as well as in the simultaneous existence of a *pes equinus* in the same patient; in the form of the head of the upper-arm-bone being peculiar, and quite different from any change which he has noticed as consequent on disease or in old dislocation of the usual kind. SMITH is not disinclined to find a resemblance between this congenital dislocation and that described by many writers, as *partial dislocation* of the upper-arm-bone, as well as that arising sometimes from rheumatic affection of the shoulder-joint, (A. COOPER,) or as an unusual atrophy of the upper-arm (CURLING.) He also supposes that in subacromial dislocation, the absence of the natural joint-surface, the complete resemblance of both unnatural articular cavities, the uninjured state of the tendons and ligaments, as well as the peculiar form of the head of the upper-arm-bone, speaks in favour of the congenital existence of this dislocation. With the few examinations which have been as yet made of this subject, it is not, however, possible to determine with certainty whether the cause of the dislocation should always be sought for in an original deficient formation of the joint surfaces, or whether such dislocations be not produced by the peculiar position of the child, and during birth, and the particular changes subsequently found, on examination, do not depend on the long continuance of the dislocation, and the previously incomplete development of the bones, and so on.

In support of this opinion at least speaks an observation of GUILLARD (*a*), who reduced a congenital dislocation of the upper-arm-bone by horizontal extension after sixteen years. The reduction was effected after several futile attempts, and when effected it relapsed twice, and was again reduced. After the last reduction, however, the upper-arm for two years and a-half was not displaced, and the movements of the limb were almost entirely natural.

VII.—OF DISLOCATIONS OF THE FORE-ARM.

1044. These dislocations are distinguished into *dislocations of the fore-arm from the upper-arm*, and the *separate dislocations of the* spoke-bone and cubit.

A.—OF THE DISLOCATION OF THE FORE-ARM AT THE ELBOW-JOINT.

(*Luxatio Antibrachii*, Lat.; *Verrenkung des Vorderarmes*, Germ.; *Luxation de l'Avant-bras*, Fr.)

1045. Complete dislocations of the elbow occur but rarely, on account of the great strength of the joint, and are always accompanied with considerable tearing of the soft parts. The dislocation may be either *backwrads* or *lateral*, but dislocation *forwards* is impossible without simultaneous fracture of the *olechranon*.

1046. The dislocation *backwards* is the most common, and always the most complete. The coronoid process of the cubit gets behind the pulley-like joint-surface of the upper-arm-bone, and rests in the pit formed for receiving the *olechranon*. The joint-surfaces of the upper-arm-bone are thrown upon the front of the spoke-bone and cubit, between the coronoid process and the insertion of the *m. biceps*. If the lateral ligaments are torn, the muscles surrounding the joint, the skin, and even the brachial

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(*a*) Révue Médicale, Aug., 1840.

artery may be torn. The *olechranon* forms a considerable projection, on the back of the upper-arm, whereby the lower part of the *m. triceps* is twisted, and above the projection of the *olechranon* the upper-arm seems to be somewhat hollowed. On the front of the joint is felt a large hard swelling, beneath the tendon of the *m. biceps;* the fore-arm is fixed in a half-bent position, except when there is considerable tearing of the ligaments.

1047. If the *cubit alone*, be thrown *backwards*, without simultaneous dislocation of the *spoke-bone*, behind the upper-arm-bone, the deformity of the joint is considerable, the fore-arm and hand being twisted inwards, the *olechranon* projecting, whilst the head of the spoke-bone retains its natural position; on the outside of the elbow-joint a remarkable projection, and on the inner a pit; the fore-arm cannot be straightened except by violence, which will reduce the dislocation, neither can it be bent farther than to a right angle (A. Cooper); the arm has been, however, observed motionless in extension, and every attempt at bending was painful and unsuccessful; pronation and supination could, however, be freely performed, the latter somewhat less than the former. If the fore-arm be but little bent, the annular ligament of the spoke-bone remains uninjured; but on greater bending, this ligament, the upper part of the interosseous ligament, and several muscular fibres are torn, and the head of the spoke-bone rests against the upper-arm. The distinguishing marks are, projection of the *olechranon*, and the twisting of the fore-arm inwards (*a*).

1048. The *lateral* dislocation may be either *complete* or *incomplete;* that *outwards* is more frequent than that *inwards*. In the former, the internal joint-surface of the upper arm-bone projects more or less, and the joint-surface of the cubit is thrust outwards; the point of the *olechranon* rests on the back of the upper-arm, in consequence of which the fore-arm is fixed in a slightly bent position. In the latter, a part of the sigmoid cavity projects, more or less, on the inner, and the joint-surface of the upper-arm-bone on the outer side; the fore-arm is permanently bent. These dislocations cannot happen without tearing of the ligaments of the elbow-joint; even the muscles of the fore-arm may be torn at their origin; hence also frequently, the fore-arm is not so fixed in its position, as in dislocation backwards. In complete lateral dislocation, the projection of the ends of the fore- and upper-arm are much more decided than in the incomplete, and on account of the great tearing of the soft parts the fore-arm is movable in every direction.

As in dislocations of the fore-arm, the joint-surfaces are mostly still in contact, so there may be crackling on moving the joint.

1049. Dislocation *backwards* of the fore-arm, is mostly produced by a fall upon the outstretched hand, whilst the fore-arm is bent and the upper fixed. If the fore-arm be violently forced to one or other side, lateral dislocation may be produced.

1050. Dislocations of the elbow-joint always produce severe inflammatory symptoms, and may lead to gangrene and nervous symptoms; generally, however, they are not dangerous. If left alone, they in a short time become irreducible; the dislocation backwards has, however, been reduced after existing two or three months. If in dislocation backwards, the joint-

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(*a*) Cooper, Astley, above cited, p. 472.—Révue Médicale, 1830.—Sedillot; in Gazette Médicale, 1839, No. 24.—Froriep's N. Notizen, July, 1839, No. 228.—Michaelis in von Graëfe and Walther's Journal, vol. xxix, p. 296.

surfaces of the upper-arm-bone project through the skin, the case is always very serious, though experience proves that a cure may take place without any particular symptoms. If with this dislocation, there be tearing of the *m. biceps*, of the brachial artery or of the median nerve, the case is exceedingly dangerous. The complete lateral dislocations are more severe than those backwards. The incomplete dislocations are neither great nor difficult to reduce; even if they be mistaken the consequences are less important, if only early motion be used.

(1) Astley and Bransby Cooper (*a*) effected reduction after three months. Malgaigne and Lisfranc reduced a dislocation of the elbow backwards, of fourteen weeks' standing in a boy ten years old.

1051. The *reduction* of dislocations of the elbow is not difficult, if undertaken sufficiently early. Extension and counter-extension are performed by two assistants, one of whom grasps the fore-arm above the wrist with one hand, and its upper inner part with the other; the second assistant places one hand on the shoulder, and with the other draws back the lower part of the upper-arm. The Surgeon, in the dislocation backwards, grasps the elbow with both hands in such way, that the four fingers of the one are upon the front, and the thumb upon the back of the upper-arm, with which when the extension is sufficiently made, he can press the *olechranon* downwards and forwards. Astley Cooper puts the patient on a stool, places his knee on the inside of the elbow, grasps the wrist and bends the arm; at the same time he thrusts his knee against the spoke-bone and cubit, to free them from the upper-arm-bone, and whilst he keeps up the pressure with his knee, he strongly but slowly bends the arm. The arm may also be violently bent around a bed-post. After complete reduction, the elbow-joint is to be surrounded with moistened compresses, a ∞ bandage applied and the arm to be put in a sling. The supervening inflammatory symptoms must be removed by a proper antiphlogistic treatment, and the continual employment of cold applications. The bandages should be removed every two days, so that gentle movements of pronation and supination may be made, in order to ascertain the actuality of the reduction. The dislocation of the cubit alone, is always easily reduced by one of the prescribed methods; but if, as in the cases mentioned by Sedillot, the fore-arm be extended, extension must be made, and then the arm bent.

If the coronary ligament of the spoke-bone be not torn, that bone retains its proper position on the cubit; but if it be torn, the spoke-bone must be pressed especially into its place, and the recurrence of its displacement prevented by a splint placed along its back. If in dislocation backward, the lower ends of the upper-arm-bone be driven through the skin, the reduction is not thereby rendered difficult; it must be performed as soon as possible, and the wound closed. If severe inflammation exist, sawing off the projecting ends may alone be sufficient to lessen the symptoms. In tearing of the brachial artery and median nerve, the former must be tied before the reduction; however, the probable danger of gangrene in this case may render amputation necessary.

1052. The *reduction* of the lateral dislocation must be effected in the way mentioned, only the joint-ends of the bones must be pressed, with both hands, in the opposite direction to that in which they are dislocated. In these dislocations also Astley Cooper makes extension upon the knee, as already stated. Violent extension of the arm is also often sufficient. The inflammatory symptoms in lateral dislocation, are always more severe than in that behind; therefore also is a more strict antiphlogistic treatment required.

(*a*) Above cited, p. 441.

1053. Though dislocations of the elbow-joint have great disposition to become irreducible, yet if severe inflammation have come on, reduction must not be undertaken till that has been removed. Before attempting the reduction of an old dislocation, repeated motions of the fore-arm are to be made for several days previously. If repeated attempts do not succeed, violent extension must be abstained from, because otherwise severe inflammation is to be feared.

In dislocation of the elbow-joint forwards, which can only occur with fracture of the *olechranon*, the same treatment must be adopted as in that fracture, with simultaneous antiphlogistic remedies.

1054. The dislocation *backwards of the spoke-bone* is the most common, but occurs more rarely in adults, than in young persons, in whom it does not take place at once; but by the habit of pulling the child by the hand a considerable relaxation of the articular connexions of the spoke-bone is produced, which is often manifested by great projection of its end, and painful swelling of its joint, and if the violence be persisted in, dislocation of the radius backwards is produced. At the moment when the dislocation occurs the patient feels severe pain, the arm is bent, and the hand prone; supination is impossible and increases the pain; the hand and fingers are moderately bent; the upper end of the bone forms a distinct projection.

1055. The dislocation *forwards of the upper end of the spoke-bone*, is the consequence of violent supination. The fore-arm is slightly bent, but cannot be brought to a right angle with the upper arm; if the fore-arm be suddenly bent, the head of the bone strikes against the front of the upper-arm-bone, by which the flexion is suddenly stopped. The hand is prone, but can be brought again perfectly into pronation and supination, although pronation is nearly complete. The head of the spoke-bone can be felt, especially in rotation, which together with the continued flexion of the fore-arm are the most decided characters.

Boyer doubts the possibility of dislocation forwards without fracture at the same time; in which case the supination necessary to produce this dislocation is prevented by the lesser head of the upper-arm-bone, which thrusts violently against the head of the spoke-bone. This opinion, however, is contradicted by foreign and by my own experience. A. Cooper (*a*) has seen the dislocation of the spoke-bone forwards six times; I have seen it twice, and once as an old dislocation in a corpse. The spoke-bone separates from the cubit, at its connexion with the coronoid process, and its head is drawn back into the hollow above the outer condyle of the upper-arm-bone, and upon the coronoid process of the cubit. Examination shows the head of the spoke-bone drawn up into the cavity above the outer condyle of the upper-arm-bone, the cubit in its natural place; the coronary ligament of the spoke-bone, the *chorda transversalis*, the front of the capsular ligament and the interosseous membrane are partially torn, and in consequence of the tearing of the latter the separation of both bones is produced.

Rouyer (*b*), Villaume (*c*), and Gerdy (*d*) have also seen dislocation of the upper ends of the spoke-bone forwards; B. Cooper (*e*) noticed it once with fracture of the inner condyle of the upper arm, and once with a fracture of the spoke-bone an inch and a-half from its head.

Simultaneous dislocation of the spoke-bone forwards and of the cubit backwards, have been noticed by Bulley (*f*) and by Vignolo (*g*).

A longitudinal dislocation of the spoke-bone, in which the head was displaced laterally and above, over the outer condyle of the upper-arm-bone, was seen by Adams (*h*).

(*a*) Above cited, p. 474.
(*b*) Journal Général de Médecine, April, 1818.
(*c*) Froriep's Notizen, March, 1828, No. 429.
(*d*) Archives Générales de Médecine, March, 1834.
(*e*) Above cited, p. 457.
(*f*) Prov. Med. and Surg. Journal, 1841.
(*g*) Révue Médicale, 1841.
(*h*) Dublin Journal of Medical Science, 1840, vol. xvii. p. 504.

1056. The *reduction* of this dislocation of the spoke-bone is easy. The fore-arm is extended with one hand, whilst with the other, the head of the spoke-bone is pressed into its place, and the fore-arm brought into supination, in the dislocation backwards, and into pronation, in that forwards, and should be kept in place after the joint has been surrounded with compresses and circular bandages, by a splint placed on its front or back part. In from twenty to twenty-five days, this apparatus may be entirely removed and careful motion of the arm permitted.

According to Astley Cooper, the reduction of the dislocation forwards of the spoke-bone, requires much force, and he enumerates cases, in which it was impossible; from experiments on the dead body, however, the extension of the hand, in which the spoke-bone alone was acted on, was the most preferable; in this way I have also easily effected the reduction.

If the appearances mentioned (*par.* 1054) indicate the relaxation of the articular connexions of the spoke-bone, all dragging and movement of the hand must be avoided, the fore-arm must be fixed in a half-bent position, and the relaxation of the ligaments removed by suitable applications and rubbings in.

VIII.—OF DISLOCATIONS OF THE WRIST.

(*Luxatio Carpi*, Lat.; *Verrenkung des Handgelenkes*, Germ.; *Luxation du Poignet*, Fr.)

1057. Three kinds of dislocation may take place at the wrist-joint:—1, the dislocation of *both bones of the fore-arm;* 2, the dislocation of the *spoke-bone;* and, 3, the dislocation of the *cubit.*

1058. Dislocation of the *hand* from its connexion with both bones of the fore-arm, may be *forwards*, *backwards*, or to *one* or *other side;* the two latter kinds can only be *incomplete*, the former two more or less perfect. In the dislocation forwards, the hand is bent much backwards, and there is a great projection upon the inside of the wrist; the fingers are bent as well as the fore-arm. In the dislocation backwards, the very contrary symptoms occur; fracture of the spoke-bone mostly accompanies it (A. Cooper.) In dislocation on one or other side, there is always distortion of the hand, adduction or abduction, and a projection on the radial or ulnar side.

Dislocation of the wrist-joint, mentioned from the earliest time, has been doubted by Dupuytren, as he denied its existence, and almost its possibility, and proved the presumed cases of such dislocations were fractures of the lower end of the spoke-bone. This opinion is almost generally received, and by a strict criticism of the previous observations of such dislocations supported, against the opinions of Petit, Desault, Boyer and others. But few observations have excited doubts against the statements of Dupuytren. Voillemier has however shown the existence of such dislocations, by the most careful examination of a complete displacement of the wrist backwards and of the bones of the fore-arm forwards, and has given, as distinguishing marks between this dislocation and fracture of the lower end of the spoke-bone, that in the latter there is a bending in on the outside of the fore-arm near the joint, which is wanting in the former; the hand is abducted, but in dislocation, the whole hand is twisted towards the outside of the fore-arm; there is swelling at the fore and under part of the fore-arm, which is wanting in dislocation; but little decided projection of the ends of the fracture forwards and backwards, whilst in dislocation a projection of seven or eight lines backwards is formed by the wrist-joint, and forwards by the bones of the fore-arm; great breadth of the bones on the carpo-metacarpal surfaces, but in the dislocation only the natural breadth; the spoke-bone is shorter, but in dislocation of equal length as in the sound arm; the styloid process of the spoke-bone has its natural place at the wrist, but in dislocation it is situated on the inside of the wrist, to the inner side of the scaphoid bone; the styloid process of the cubit projects upon the back of the fore-arm, but in dislocation on the front; it projects as far or farther down than that of the spoke-bone, whilst in dislocation the styloid processes retain their reciprocal position; the position of the hand, usually though not always, is bent backwards, in dislocation commonly bent.

Compare *par.* 653, where is given the literature of fracture of the lower end of the spoke-bone; VOILLEMIER, in Archives Générales de Médecine, 1842, March; PRINZ, G., Ueber den Brüch am unteren Ende des Radius. Erlangen, 1842.

1059. The cause of this dislocation is always, a very violent bending of the hand in this or that direction; hence the ligaments are always much torn, and the tendons on the side of the dislocation very severely torn and stretched. Rarely are other of the soft parts besides the ligaments ruptured.

1060. The *reduction* of dislocation of the hand is not difficult. Extension of the hand and pressure upon the carpal bones in the contrary direction to which they are dislocated, is sufficient. After reduction, the wrist is to be wrapped up in moistened linen, and fastened with a circular roller. If there be a disposition to re-dislocation, which in the dislocation forwards and backwards is generally the case, a splint must be placed on the palmar and dorsal surfaces of the hand, and confined with a circular bandage. Severe inflammatory symptoms always arise, which require suitable treatment and cold applications. Subsequently, aromatic applications, spirituous rubbings, and so on must be used to disperse the often long-continued swelling of the wrist-joint.

1061. In dislocation of the *spoke-bone alone*, which is rare, it is displaced on the front of the *carpus*, resting upon the navicular and great multangular bones. The outside of the hand is twisted backwards, and the inside, forwards; the end of the spoke-bone forms a projection on the front of the *carpus*, and its styloid process is no longer opposite the great multangular bone. The cause of this dislocation is a fall on the hand whilst turned backwards. The treatment is the same as that for both bones.

1062. In dislocation of the *cubit*, which is more rare, and in which the sacciform membrane is torn, the bone usually projects backwards, forming a protuberance on the back of the wrist, and although it can be easily pressed into its natural place, the deformity recurs when the pressure is withdrawn. The diagnostic sign is the projection of the cubit over the cuneiform bone and the dislocation of the styloid process from the line of the metacarpal bone of the little finger. Pressure restores the bones to their place, in which they are to be retained by splints on both surfaces of the arm and compress on the end of the cubit.

IX.—OF DISLOCATION OF SINGLE BONES OF THE HAND.

1063. The *great bone* (1) alone, can be displaced from its connexion with the scaphoid and semilunar bones, backwards, in consequence of violent bending of the hand; by which a circumscribed swelling is produced on the situation of the great bone, in the direction of the middle finger, which disappears on pressure, but recurs when the pressure is withdrawn. The *reduction* is easily effected by pressure upon the projecting head of the bone, or if this be insufficient, by simultaneous pulling at the fore and middle finger. The hand is to be kept extended, until it be laid upon a flat board, pressure made upon the projection with a compress, a splint applied, and the whole fixed with a roller. If it remain, in a slight degree, it is not accompanied with any inconvenience.

(1) Not the trapezial bone as stated by B. **Cooper** and others.

Gras (*a*) has described a dislocation of the *pisiform* bone.

The *great* and *unciform* bones are often thrust somewhat out of their place, in consequence of the relaxation of their ligaments, so that in bending the hand they form a projection on the back of the wrist, and the hand cannot be at all used without supporting the wrist. Strips of sticking plaster and a bandage are usually sufficient for supporting the wrist, and the parts may at the same time be strengthened with the douche bath, and rubbing in volatile ointments and the like.

1064. The *metacarpal bone of the thumb* is alone subject to dislocation from its connexion with the trapezial bone, in consequence of violent bending. The projection which the displaced end of the bone forms above, is very slight, the thumb is bent towards the palmar surface, and cannot be straightened. In reducing it, the extension and counter-extension are made at the thumb and *carpus*, and the displaced joint-end is to be pressed into its place. To retain it there, the thumb should be enveloped in compresses and a circular bandage, and a thin splint fastened on its hinder surface. If the dislocation be mistaken, which easily happens when swelling exists, the movements of the thumb are permanently prevented.

1065. The *phalanges of the fingers* may be dislocated forwards and backwards, by violent bending in either direction. In the dislocation *forwards*, the dislocated bone is bent backwards, the other fingers are bent, the projection of the dislocated joint-surface is on the palmar side; in dislocation *backwards* the contrary happens. In dislocation of the thumb *upwards* from its metacarpal bone, the thumb stands almost at a right angle on the metacarpal bone, with the nail-joint bent; and the head of the metacarpal bone forms a large projection on the volar surface. If these dislocations have existed only a short time, they cannot be reduced.

The *reduction* requires great force, as the edges of the joint-surfaces resist each other, and must be separated. This can only be effected, by means of a clove hitch applied round the phalanx. If in compound dislocation the joint-surfaces project out of the soft parts, and their reduction be not possible, they must be cut off, and their replacement effected; this in one case of compound dislocation of the thumb I performed with the best success.

Dislocations of the thumb from the metacarpal bone, most frequently occur, and cause greatest difficulty in their reduction. According to **Roser** (*b*), who has collected the various opinions upon this dislocation, together with his own observations, the dislocation is always direct, and on the same side on which the violence has occurred. If a person, fall on the ground with his thumbs outstretched, a dislocation takes place on the back, and not in the front of the hand; the thumb is fixed in hyper-extension or dorsal flexion, and forms, often almost a right angle with its metacarpal bone, which makes a considerable projection in the hollow of the hand, and has frequently been mistaken for the dislocated projection of the head of the phalanx, as stated by **Fincke** (*c*). I possess an old dislocation upwards of the thumb, in which the position of the two bones corresponds entirely with this statement. The difficulty of reducing this dislocation is often so great, that laying bare the old bone, and cutting off the interfering tendons and ligaments has been recommended, (**Desault**, **Dupuytren**,) and even the removal of the projecting end of the bone itself, (**Evans**, **Vidal**.) In general the jutting against each other of the edges of the joint-surfaces is considered as preventing the reduction; A. **Cooper** held the interposition of the sessamoid bones to be the cause; **Lisfranc** and **Dupuytren** place it in the remarkable position of the tendon of the *m. flexor longus*, which is displaced backwards and downwards, so that it lies midway between the phalanx and the head of the metacarpal bone. **Hey** thinks the cause to be in the lateral ligaments, between which the head of the metacarpal bone, on account of its wedgelike

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(*a*) Gazette Médicale, vol. iii. 1835.

(*b*) Die Verrenkungen des Daumens von seinem Mittelhandknochen; in Archiv. für physiologische Heilkunde, 1843, pt. 2.

(*c*) **Casper's** Wochenschrift, 1838. No. 18.

shape, slips out more easily than it can be got back again. **Vidal** and **Malgaigne** conclude from their observations on the dead body, that the hindrance depends on the locking-in of the metacarpal head between the short muscles of the thumb. **Pailloux**, **Lawrie**, **Blechy**, and **Roser**, by their experiments, found the interposition theory confirmed, and the latter could produce the interposition, as often as he pleased, if only the front of the capsule were torn or cut across, and at the same time a little lengthways. In consequence of these various opinions, different proposals have been made to effect the reduction. According to **Hey**, the bones may be brought into place by pressure without extension; according to **Charles Bell**, bending the joint with proper pressure. **Fincke** applies his two forefingers on the back of the metacarpal bone, presses with it against the thumb, whilst his two thumbs are firmly placed against the under surface of the metacarpal bone, and thus easily effect its replacement. **Charles Bell's** proposal of subcutaneous division of the lateral ligaments with a cataract-needle has been practised by **Liston** and **Reinhardt** (*a*). **Roser**, from his experiments on the dead body, determines that the reduction can only be effected, when the bone is put into the position out of which it was thrown, and also if the dislocated phalanx be first put in hyper-extension, (dorsal flexion,) and from this be moderately depressed upon the metacarpal head.

From all this it appears that the joint must be neither straightened nor bent too much, the direction of the thumb must always be such, that its long axis be directed perpendicular to the rounded surface or the metacarpal head. If this direction be given to the bone, the tilting in and interposition, and with them the obstacle, disappear. I have, in six cases of dislocation of the thumb from the metacarpal bone, been only once unable to effect the replacement perfectly, in which the dislocation had already existed some days. My practice in this reduction is, to apply a wetted bandage around the thumb, thee nds of which are rolled round my own hand, and whilst with this I pull *directly* upwards, the left hand is placed on the *metacarpus* and pressed down, whereupon I bring the thumb into the straight position. I must however confess, that all these cases I had considered as dislocations of the thumb downwards.

X.—OF DISLOCATION OF THE THIGH-BONE.

(*Luxatio Femoris*, Lat.; *Verrenkung des Oberschenkels*, Germ.; *Luxation de la Cuisse*, Fr.)

Boyer, above cited, vol. iv. p. 278.

A. **Cooper**, above cited, p. 37.

Travers, B., in Med.-Chir. Trans., vol. xx. p. 112.

1066. Dislocations of the thigh may occur in four directions:—1, *backwards and upwards upon the back of the hip-bone*; 2, *inwards and downwards into the oval hole*; 3, *backwards and downwards into the ischiatic notch*; 4, *upwards and forwards on the horizontal branch of the share-bone*. The former of these is most frequent, the fourth more rare than the second, and the third the most rare, and even denied by many writers. The capsule, as well as the round ligament, is torn in every one of these dislocations, though in that inwards and downwards it may remain entire.

Astley Cooper (*b*) gives other proportions in reference to frequency of the several dislocations of the thigh-bone; he says that the dislocation backwards and upwards is the most frequent, next that into the ischiatic notch, then that on the oval hole, whilst the dislocation on the share-bone is most rare. Besides these four kinds of dislocation of the thigh-bone, some assume a fifth, viz., *directly downwards*, just as others consider the above four kinds only secondary, in which the head of the bone, if there be no fracture of the socket, always leaves the socket at its *lower* edge, and is first situated between this part and the tuberosity of the haunch-bone, though only for a short time.

[Although repeated dislocation of the thigh-bone in the same person is not very common, yet a few years ago there was a woman in St. Thomas's Hospital, under **Tyrrell's** care, whose hip was dislocated the ninth time. Unfortunately I do not recollect the kind of dislocation.—J. F. S.]

(*a*) Preuss. Vereins Zeitung, 1836. No. 23.

(*b*) Above cited, p. 39.

1067. In the dislocation *upward and backwards*, the head of the thigh-bone gets upon the outer surface of the hip-bone, and rests between the external iliac pit and the *m. gluteus minimus*; hence the foot is an inch and a half, or two inches and a half shorter, the toes are turned towards the *tarsus* of the other foot; the knee and foot turned inwards; the limb cannot be separated from the other, but the adduction which exists can be increased, that is, it can be bent obliquely over the other. If there be not any considerable effusion of blood or swelling, the head of the thigh-bone may, by rotation of the knee, be felt distinctly upon the outer surface of the hip-bone; the *trochanter* projects less and is nearer the spine of the hip-bone; the rounded form of the hip is lost. Such extension of the limb as can be made with the hand does not restore its natural length. If the dislocation be old, the limb retains its position inwards, and the patient can tread only upon the toes; notwithstanding the great shortening of the limb, the patient will gradually be able again to walk. Under these circumstances the somewhat flattened head of the thigh-bone lies on the outside of the hip-bone, in a corresponding hollow, surrounded by a newly formed bony mass. The least and middle gluteal muscles are extended, and converted into a cellular fibrous mass; the thigh diminishes in size. This dislocation is produced by a fall, or some other violence, which drives the thigh inwards and forwards. It happens the more easily, the farther the violence acting on the thigh-bone is distant from the hip-joint, and if at the same time the gluteal muscles be contracted.

1068. In the dislocation *inwards and downwards*, the head of the thigh-bone gets into the oval hole. Although the condition of the socket seems most favourable for this kind of dislocation, it, however, happens very rarely, because it can be only produced by a fall, when the thighs are far apart. The affected limb is two or three inches longer; the head of the thigh-bone is felt, by pressing with the hand upon the upper inner part of the thigh towards the *perinæum*; the *trochanter* is less prominent; the body is bent *forwards*, on account of the extension of the *m. psoas* and *iliacus*, but when the body is erect the limb projects; the knee is wide apart from the other, and cannot be brought near it without great pain; the foot is also separated from the other, but cannot be twisted either inwards or outwards. The thigh seems as if united, with the *pelvis* and has no mobility. If the dislocation be left alone, the limb remains immovable, in the position described; it has, however, been noticed (*a*) that the external obturator muscle is destroyed, and that the ligament of the oval hole is converted into a mass of bone, which surrounds the head of the thigh-bone as a socket in which it can move.

Ollivier (*b*) describes a dislocation of the thigh-bone *directly downwards*, of which he gives the following symptoms:—the thigh slightly bent at the hip-joint, was a little rotated inwards, and separated from that of the other side; the bent thigh as well as the foot was rotated forcibly outwards; a line drawn from the iliac spine downwards falls upon the inner condyle of the thigh-bone; *no sensible lengthening*; the *m. sartorius* and *tensor vaginæ femoris* projected slightly; the outer part of the *m. triceps* was much stretched; the flank showed a deep fold; the great *trochanter* was directed downwards and backwards; the buttock rounded and prominent; the head of the bone was not in the least felt; the extension of the thigh was impossible; the leg might be straightened; adduction, although painful and little, was easy; abduction could be increased.

1069. Dislocation *backwards and downwards* into the ischiatic notch,

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(*a*) Astley Cooper, above cited, p. 66.

(*b*) Nouvelles Espèces de Luxation du Fémur; in Archives générales de Médecine, June, 1824.

happens very rarely, because it can only occur, when the thigh is so near the trunk and the other thigh, that it is scarcely possible. **Boyer** considers this as secondary, after dislocation of the head of the thigh-bone upwards and backwards, when the thigh is much bent and adducted. In this dislocation, the head of the bone lies on the *m. pyriformis*, between the edge of the bone which forms the upper part of the ischiatic notch, and the sacro-ischiatic ligaments, somewhat above the mesial line of this cavity. It is very difficult to distinguish this dislocation, because the length and direction of the limb are but little changed. The extremity is ordinarily half an inch shorter; the *trochanter* is behind its usual place; the head of the thigh-bone can only be felt in emaciated persons, when the thigh-bone is brought forwards as far as possible; the knee and foot are turned inwards, though, however, not so much, as in the dislocation upwards and backwards; when the patient stands he only touches the ground with his toes; the knee is somewhat projected and slightly bent; the limb is fixed in its position.

1070. In the dislocation *upwards and inwards*, the head of the thigh-bone gets beneath **Poupart**'s ligament, upon the horizontal branch of the share-bone; it is rare, and produced by violence which thrusts the thigh backwards and the *pelvis* forwards; for instance, a careless step with the foot into a hole, in which case the upper part of the body is bent backwards. The *diagnosis* is easier than in any other dislocation of the thigh. The limb is fixed in strong extension, abduction, and great rotation outwards; it is about an inch shorter, the *trochanter* is nearer the spine of the hip-bone and less prominent; the head of the bone is felt on the horizontal branch of the share-bone; the buttock is flattened and stretched; the vessels of the thigh are twisted inwards, and pulsate distinctly, and even perceptibly, to the eye. In every attempt to bend the thigh, or draw it inwards, severe pain is produced. In old dislocations of this sort it has been found, that the form of the head of the thigh-bone, lying between **Poupart**'s ligament and the share-bone, is changed, that it is more flattened, and around the neck a kind of bony collar is produced.

Upon the distinguishing characters between the dislocations of the thigh and fracture of the neck of the thigh-bone see *par.* 671.

1071. As regards the *prognosis* of dislocations of the thigh, they are usually not accompanied with any unfavourable symptoms like those of the shoulder-joint, as after the reduction is completed, in general, the inflammation and swelling soon subside; however, in uncommon cases the inflammation runs on to suppuration, and causes the patient's death (*a*).

The *reduction* of these dislocations is more difficult than all others, especially in robust persons. The dislocations inwards and downwards, and inwards and upwards, are generally more easily reduced than that backwards and upwards. The earlier reduction is attempted, the more quickly is it effected. At what time the reduction of a neglected dislocation is still possible, is probably very different, in different persons, as in some cases it can be effected after some months, but in others, after several weeks is impossible. To what degree the movements of the thigh are hindered by an old dislocation, has been already mentioned, in speaking of the several kinds.

1072. As the reduction of dislocation of the thigh always finds consi-

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(*a*) **Astley Cooper**, above cited, p. 7.

derable opposition in the powerful contraction of the muscles, so is it in no dislocation of greater consequence than in this, to lessen these contractions by such remedies as effect relaxation in the whole organism. The patient should be bled according to his constitution, should be put in a warm bath, and every ten minutes a grain of tartar emetic given till *nausea* ensues. It must, however, be determined according to the patient's condition, whether previous to the use of these means, an attempt at reduction should be made, and if this attempt fail, then to resort to these remedies.

1073. The reduction itself consists in proper extension and counter-extension, which is effected either by assistants or by means of pulleys. Of the former practice in general the French, and of the latter the English Surgeons speak in favour. I myself also consider the latter the most certain and most suitable, especially if the dislocation be already of long standing.

1074. In extension and counter-extension by assistants, we proceed in the following manner; the patient lies on a table covered with a mattress; a handtowel folded together (about four fingers wide) is to be placed with its middle on the front of the foot, above the ankle, previously well covered with linen or wool, carried backwards and tied; and its ends given to an assistant. A similar towel is to be applied on the inner side of the sound thigh, also previously defended properly against pressure with a roller, and the one end is to be carried over the flank, the other outwards over the buttock, where the ends are tied and given to an assistant. For the purpose of fixing the *pelvis* still more firmly, a folded cloth is to be carried round it, between the crest of the hip-bone and the *trochanter*, the ends of which are to be tied together on the sound side, and given to an assistant. The number of assistants must be equal at the points of extension and counter-extension. The practitioner places himself on the outside of the dislocated thigh, and directs the extension.

In dislocation *outwards and upwards*, the extension must be made *obliquely from without inwards* and a *little from behind forwards.* When it is sufficiently advanced, the practitioner must with both hands press the *trochanter* downwards and backwards. in order to thrust the head of the bone back into the socket. In dislocation *inwards and upwards* extension must first be made in the direction *outwards*, the practitioner then places both his hands upon the upper inner part of the thigh, and presses it upwards and outwards, whilst the assistants, without giving up the extension, *incline* the lower part of the limb inwards. In dislocation *upwards and inwards*, the extension must be made nearly *in the axis of the body*, and the head of the thigh-bone pressed downwards and outwards. In the dislocation *backwards and downwards*, in which BOYER (*a*) states that it is probably only a secondary displacement in the dislocation upwards and outwards, the head of the bone must be first brought to its previous situation, and then treated as a dislocation upwards and outwards (*b*).

1075. WATTMANN, KLUGE, and RUST have proposed methods of replacement, in which, by diminution of the muscular contraction, and by rubbing the bones, a less outlay of power is required.

1076. According to WATTMAN'S (*c*) plan, the patient, lying on his back, is to be merely fixed by resting the healthy limb against the bed-

(*a*) Above cited, p. 288.

(*b*) Ibid., p. 302.

(*c*) Ueber Verrenkung am Hüftgelenke und ihre Einrichtung. Wien, 1826; with a copper-plate.

stead, and by pressure upon the knee to prevent it being bent. Only in great resistance of the muscles, should the *pelvis* be fixed by a long cloth carried above the hip, and fastened to a rafter between the two bed-posts. For the abduction of the thigh, a strap furnished with a roller is sufficient; one or two assistants are employed.

In the dislocation *inwards and downwards*, the thigh-strap is applied as high as possible, upon the thigh, with the buckle forwards; an assistant lays hold of the dislocated foot, in the position in which it is kept by the dislocation, above the ankle, and holding firmly, draws it slightly downwards. The Surgeon standing near the patient, rests with the one hand upon the crest of the hip-bone, and with the other hand so seizes on the bandage, that it is directed under the fore and upper iliac spine, and crosses the axis of the thigh at a right angle. He then, with the requisite force, pulls outwards parallel to the direction of a line which may be supposed to be drawn a hand's breadth behind the anterior upper iliac spine on the sound side, through the body to the tip of the same process on the ailing side. In this way the extensors and flexors are but slightly stretched, and the rotating muscles first participate in the flexion, when the head approaches the edge of the socket. By the ordinary flexion of these muscles the head may be lifted into the socket.

In dislocation *inwards and upwards*, an assistant lays hold of the ailing foot above the instep, carries it upwards upon the outside of the sound foot, and keeps it in this position without drawing, whilst the pull, with the bandage, applied as in the former case, is made by the Surgeon in a line supposed to be drawn from the tip of the fore and upper iliac spine of the sound side towards the *trochanter* of the dislocated thigh outwards, and obliquely upwards. So soon as the toes hitherto pointing outwards, become pointed forwards, a slight pull at the ankle in the direction of the long axis of the thigh-bone, furthers its elevation into the socket, which is effected by the extended rotating muscles.

In the dislocation *backwards and downwards*, the foot is grasped by an assistant above the ankle, and drawn over the sound limb across and downwards. The bandage, applied as above described, is drawn gradually and strongly outwards and forwards, in the direction of a line parallel to one supposed to be drawn two hands' breadth behind the fore and upper iliac spine of the sound side through the body to that of the injured side. The drawing is to be continued, till the thigh itself turns outwards on its long axis, when the head of the bone is pulled into the socket, by the much stretched rotating muscles.

In dislocation *outwards and upwards*, the thigh may either be drawn in its own axis forcibly downwards, and by the thigh-strap outwards and downwards, or an assistant must grasp the dislocated thigh in its axis inwards at the knee and ankle, and slowly lift it forwards, till it forms a right angle with the long axis of the body, and till the fore, still inner edge of the great *trochanter*, comes directly beneath the fore and upper iliac spine. If the thigh be yet of itself so much twisted on its long axis that the hitherto inwards turned toes are twisted forwards, and even rather outwards, and by this self-twisting of the thigh, which cannot be prevented by fast holding, is the movement of the head of the bone over the socket declared. The assistant must now gradually let down the thigh till it lies close to the other, upon the bed, whereupon the reduction follows.

1077. In order to properly fix the *pelvis*, the patient must (according to Kluge) (*a*) be laid on his back, upon a table covered with a mattress, and between the thighs, covered with a compress, a stout towel drawn, of which both ends must be held by an assistant standing at his head; a second towel is to be carried round the *pelvis*, and both ends given to an assistant standing on the uninjured side of the patient; a third towel is to be placed around the *pelvis*, between the spines of the hip-bone and the *trochanter*, carried round the table or bedstead, and tied so as to prevent the elevation of the *pelvis*. The thigh and leg are now bent by an assistant, to relax the flexors, and at the same time abducted, to relieve the stretching of the gluteal muscles, and the knee should be rotated inwards, by which the head of the bone, being set free, resumes its primary direction, whilst the capsular ligament holds it fast above. The head of the bone is guided from its primary direction usually by a slight twist or pull at the knee, or it is lifted up by the Surgeon, standing at the injured side, partly with his hands, partly with a cloth employed as a lever.

According to Rust's (*b*) plan the patient being fixed as recommended by Kluge, a folded cloth is to be applied around the upper part of the thigh; the thigh drawn down, and at the same time raised by a strong assistant, who grasps it above the knee, which is to be bent, for the purpose of bringing the head nearer the under part of the socket; then it is to be drawn and abducted, upon which, by the action of the muscles, it springs into the socket with an audible noise, without the employment of any considerable extension being requisite.

Colombat (*c*) proposes a mode of reduction which he has always successfully employed without assistance and without pain to the patient. The patient stands upright upon the undislocated limb, his chest bent forwards and resting on a table or high couch, withs his hands grasping the opposite sides of the table or couch, to keep his body immovable during the operation. The Surgeon places himself behind the patient, on the inside of the dislocated limb, if the dislocation be forwards, but on the outside if it be backwards. He puts first one hand above the *tarsus*, to bend the leg upon the dislocated thigh; the other hand, which lies behind the knee, is employed to make gradual pressure from above downwards, for the convenience of extending the muscles. With the first hand he imparts to the limb gentle motions from right to left, and from before to behind, in order to overcome the opposition of the muscles of the thigh, and to render the head movable, which then moves from the place in which it is, and enters the socket with a noise.

1078. In the reduction of dislocations of the thigh with pulleys, the following mode is to be pursued.

In the dislocation *backwards and upwards*, the patient should be placed upon a table, and a girth carried between the *pubes* and upper part of the thigh, outwards and upwards, and fastened to a hook behind the patient. Above the knee should be applied, around the thigh, a linen pad, and over it a leathern strap, from which other straps descend, and are connected with the pulley fastened before the patient. The knee is to be a little bent, but not at a right angle, and directed somewhat obliquely over the other limb. The drawing of the pulley is to be slowly continued, till everything is tight and the patient complains of pain; this degree of extension should be kept up to relax the muscles; then it is to be repeated till the patient complains, and in this manner continued till the head of the bone comes down. When it comes to the edge of the socket, the same degree of extension must be kept up, and the knee and foot rotated outwards without violence. It is often necessary to carry the arm beneath the thigh, near to the joint, for the purpose of lifting the head of the bone over the socket.

In the dislocation, *inwards and downwards*, the patient is to be put on

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(*a*) Sich, G. R., Dissert de. luxatione femoris. Berol., 1823, p. 26.

(*b*) Richter, above cited, p. 706.

(*c*) Ueber die Merotropie bei den Luxationen des Hüftgelenkes; in Froriep's Notizen, Sept. 1830.

(*d*) Astley Cooper, above cited, pl. viii. fig. 1.

his back, the *pelvis* fixed with a girth, as in the latter case, the dislocated limb grasped above the ankle and drawn over the uninjured one. In general, however, it is necessary further to fix the *pelvis* by means of a second strap, which passes around it and crosses the former. If the dislocation have existed several weeks, it is best to put the patient on the sound side, to fix the *pelvis* in the manner mentioned, to apply the girth attached to the pulley around the thigh, and to raise the thigh when the foot is drawn down; the foot, however, is not to be brought too much forwards, because otherwise, the head of the thigh-bone overshoots the socket (*a*).

In the dislocation *backwards and downwards*, the patient must be placed on his side, the straps for extension and counter-extension employed as directed, and the extension carried on, the thigh at the same time being directed obliquely over the middle of the other. Whilst this is doing, an assistant grasps a cloth, applied round the upper part of the thigh, with one hand, and draws it up, whilst with the other he presses up on the *pelvis* (*b*).

In the dislocation *inwards and upwards*, the patient is laid upon his side, the *pelvis* fixed, and extension made above the knee. The thigh is drawn in the backward direction, around its upper part a cloth applied, which an assistant draws, whilst with the other hand he thrusts back the *pelvis*, in order to lift the head of the bone over the edge of the socket (*c*).

The reduction of the dislocation inwards and upwards, is often rendered more easy and quick than in the other way, by PALLETTA's method, in which the dislocated thigh is suddenly and violently bent towards the belly, when it has been abducted as much as possible (*d*).

[In the dislocation downwards ASTLEY COOPER used to say, in his Lectures, that it might be reduced by interposing the bedpost between the thighs close up to the *pelvis*, and then making extension.

MORGAN and COCK, of Guy's Hospital, have reduced several dislocations of the hip-joint by placing the foot between the thighs, so that it presses against the upper part of the dislocated bone, and thrusts it away from the *pelvis*, extension and rotation of the limb being at the same time made by assistants. The principle of the operation is precisely similar to that in reducing a dislocated shoulder by putting the heel in the arm-pit. This practice was first introduced about ten years since by MORGAN (*e*), and by it he has replaced a dislocation upon the *pubes*, one on the oval hole, and one upon the back of the hip-bone, without difficulty, which he principally attributes to diverting the patient's attention from the operator's efforts by unexpectedly pricking or pinching. COCK has reduced one dislocation on the *pubes*, and two on the back of the hip-bone, by the foot between the thighs; but he informs me that the greater number of the persons so treated were weak or elderly. Till making inquiry, I was unaware of so many cases having been thus managed. I do not know that the practice has been elsewhere adopted, but I shall certainly try it, at the first opportunity, as it saves all the trouble and inconvenience of *pelvis*-straps and pullies.—J. F. S.]

1079. The completion of the reduction of a dislocated thigh-bone is indicated by the audible noise, with which the head returns into the socket, by the natural length and direction of the limb, by the cessation of pain, and by the free motion of the thigh. The replaced thigh is frequently longer than the sound one, which depends on the swelling of the ligaments of the joint. In using the pulleys, the head of the bone often returns into the socket without any noise, and the reduction is only noticed when the extension is given over. If the extension have not been sufficient, it must be resumed as quickly as possible, before the muscles have time to contract afresh. In order to prevent the recurrence of dislocation, it is

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(*a*) COOPER, ASTLEY, pl. viii. fig. 2.

(*b*) Ibid., pl. ix. fig. 3 (*c*) Ibid., fig. 4.

(*d*) Bulletins des Sciences par la Société Philanthropique de Paris, 1818, p. 285.—AMMON, Parallel, p. 170.

(*e*) Guy's Hospital Reports, vol. i. p. 79.

advisable to bind the thighs together above the knees, and to keep the patient at rest, and on his back in bed. He is to be treated generally and locally on the antiphlogistic plan, according to circumstances, and allowed to get up and walk, when the pain has entirely ceased, which usually happens towards the twenty-fifth or thirtieth day.

1080. *Congenital* dislocation of the thigh, *outwards and upwards*, into the external iliac pit, (*Luxatio Femoris congenita*,) mentioned formerly by Hippocrates, and more perfectly described by Palletta (*a*), was first carefully described by Dupuytren (*b*), and I have, up to the present time, had opportunity, in more cases, to convince myself of the correctness of his description. It is distinguished from all other dislocations, especially from spontaneous dislocation, in that, 1, it ordinarily occurs in both hips; of the nine cases, however, which I have seen, in four the dislocation was only on one side (*c*); 2, it is not preceded by any symptoms of coxalgy; and 3, it is usually first noticed in the first attempts the child makes to learn to walk, and if the attempt be continued, till the movements become wearisome. The limb in this dislocation is shortened, the head of the thigh-bone is upwards and outwards, the great *trochanter* projects; almost all the muscles of the upper part of the thigh are contracted to the iliac crest, where they produce, around the head of the bone, a sort of cone, the base of which is formed by the hip-bone, and its point directed towards the great *trochanter;* the tuberosity of the haunch-bone is freed from its muscles, and is almost completely uncovered; the limb is rotated inwards, the heel and the bend of the knee stand outwards, and the point of the toe and the knee inwards; the thighs are directed obliquely from above downwards, and from without inwards, and this obliquity becomes greater, the older is the patient and the broader the *pelvis;* hence arises the disposition of the thighs to cross each other below; the upper inner part of the thigh forms where it is connected with the *pelvis*, a sharp inward projecting angle; the whole limb wastes, especially at the upper part. The motions of the limb are very much restricted, especially abduction and rotation; the lower limbs are very backward in proportion to the perfectly developed upper parts of the body, which is the more remarkable as the *pelvis* is very broad, and not interfered with in its development. The upper part of the body inclines very much backwards; on the other hand, the lumbar *vertebræ* project much forward, the *pelvis* rests nearly horizontally upon the thigh-bones, and these persons touch the ground almost alone with the tips of their feet. When walking, they raise themselves on the tips of their feet, bend the upper part of the body very much towards that limb which still supports the weight of the body, raise the other foot from the ground, and bring, with difficulty, the latter from one side to the other. In this case, it is to be observed, that on the side supporting the weight of the body, the head of the thigh-bone rises up into the iliac pit, and the *pelvis* descends, whilst, on the other side, the displacement of the bone is lessened. In running and leaping, which for such persons is very laborious, these appearances diminish from the energy of the muscular contraction. When the person lies horizontally on his back, the diseased limbs may, by pulling and thrusting down, be lengthened and shortened,

(*a*) Exercitationes Pathologicæ, p. 88.

(*b*) In Répertoire générale d'Anatomie et de Physiologie Pathologique, vol. ii. trimestre iii. p. 151. Froriep's Notizen, No. 340, p. 153, and Chirurg. Kupfertafeln, pl. clxxx. Caillaud Billonière, sur les Luxations originelles ou congénitales du Fémur. Paris, 1828.

(*c*) On the Hip; noticed in Répertoire général d'Anatomie et de Physiologie Chirurgicales, 1827, trimestre iii. p. 22.

and are hence distinguished from the changed position of the head of the bone. These experiments may be made without pain and with the greatest ease.

1081. In the cases examined after death by **Dupuytren**, all the muscles appeared pressed against the iliac crest, and drawn up; some of them were very much developed, others shrivelled, atrophic, and even converted into a yellowish fibrous tissue. The thigh-bones were naturally formed, and only sometimes the inner upper part of the head varying somewhat from its rounded form. The socket was either entirely deficient, or appearing only as a little irregular bony protuberance, without any trace of cartilage and ligament, and without any fibro-cartilaginous edge; and about and over it, the cellular tissue and the muscles attached to the *trochanter*. Only in one case was the sound ligament lengthened, flattened, and at some parts, as it were, worn out by pressure and friction. The head of the bone was found in a kind of newly formed socket on the external iliac pit, always very superficial, and having an undefined edge. **Palletta** found the under fore-part of the socket covered with ligament, and the upper hinder-part filled with a fat-like mass; the head of the bone round, inclosed in a tough capsule, connected with the fatty mass in the socket by the round ligament, which was so long that it permitted the head to move upwards and downwards, and aside. No hollow in the bone in which the head of the thigh-bone should rest, had been formed in a child who had died sixteen days after birth. Hence, it seemed, that the above-mentioned absence of socket, and so on, was not original, but only consequent, and that this dislocation was, perhaps, simply produced by the peculiar position of the *fœtus*, or by violence during birth. The flattening, or almost complete disappearance of the socket, is explained by the long continuance of the dislocation, and must be so much more distinct in the congenital, as in the progressive development of the pelvic bones it so easily occurs. The opinion, that the congenital dislocation depends on an arrested development of the bony parts of the joint (**Breschet**) is very improbable, rests only upon the relations of the socket, after the dislocation has been long existent, and remains refuted by **Palletta**'s and **Cruvelhier**'s cases, till it can be determined by examination at the very earliest period after birth.

Compare *par.* 998 and the writers there quoted.

1082. Difficult as is the walking, and great as the lameness in this congenital dislocation, especially when on both sides, yet however it may be, in time, considerably improved when the head of the bone is fixed in its new socket (1). **Dupuytren** recommended rest and a sitting posture to effect the fixing of the head of the bone, and to permit the muscles, as little as possible, to act upon it; for strengthening the parts in the neighbourhood of the joint, daily washing of the body for some minutes in cold water, or salt water, and the constant wearing a padded leather belt, put on between the iliac crest and the great *trochanter*, and kept in its place by thigh-straps.

Recently, various attempts for the *reduction* of this dislocation, have been made by long-continued extension, and fixing the thigh with proper apparatus. (**Duval**, **Jalade Lafond**, **Humbert**, **Pravaz** (2), **Guérin**.) The possibility of a successful result is not, as already said in regard to the origin of this dislocation, to be considered as a thing decided, and must excite us to the early employment of the means of reduction; although the hitherto known cases do not irrevocably prove the actually resulting reduction, as the lengthening of the limb effected, and the diminished lameness, perhaps, depend on the displacement of the *pelvis*, or the position of the head of the thigh-bone in the ischiatic pit.

(1) I have observed one case of dislocation on both sides, in which the walking was at first extremely difficult, but from the fifteenth year and onwards so improved, that now, when the patient is about twenty years old, there is scarcely any trace of peculiar gait to be noticed.

(2) **Pravaz** (*a*) communicates a case of reduction of congenital dislocation of the thigh, in a girl eight years old, by gradual lengthening of the limb, and by violent abduction, assisted by a methodical pressure on the great *trochanter*. If the reduction be ensured by long-continued rest, various movements of the limb should be performed, the body still being at rest. He believes that even in the cases in which there is not any existing cotyloid cavity, a dislocation of the head of the thigh-bone downwards causes slight halting. A second case happened in a boy of eight years, in whom the reduction was effected by gradual extension, kept up for several months, after which gymnastic exercises were used, which were proper for strengthening the joint and perfecting its coaptation (*b*). **Guérin** effected a cure in six cases. H. **Joffre** (*c*) refers to the two cases of **Pravaz**, denies the observations of **Humbert** (*d*), and thinks that in them no perfect reduction was found, but that merely the head of the bone was situated in the ischiatic pit.

Heine, of Cannstadt, has given a very clever apparatus, which, with continued extension, permits every other seemingly necessary movement and direction of the extremity. But notwithstanding all his care and perseverance, he could not, in this dislocation of the thigh, effect any result (*e*).

Guérin (*f*) makes a preparatory and continued extension, by which the shortened muscles are lengthened and are brought to stretch out; cutting through the muscles which do not lengthen; extension of the shortened ligaments, and where this is impossible, cutting them through; reduction and its preservation by apparatus. According to **Pravaz** (*g*) every congenital dislocation may be reduced, if it be possible to bring the thighs up to the shoulders, without bending the legs against the thighs (*h*).

OF DISLOCATION OF THE KNEE-CAP.

(*Luxatio Patellæ*, Lat.; *Verrenkung der Knieschiebe*, Germ.; *Luxation de la Rotule*, Fr.)

Le Vacher et **Picquet**, Theses de variis patellæ luxationibus. Paris, 1761. 4to.

Boyer, above cited, vol. iv. p. 347.

Cooper, A., above cited, p. 178.

Malgaigne, Mémoire sur la détermination des diverses espèces de Luxation de la Rotule. Paris, 1837.

1083. Dislocation *of the Knee-cap* may happen in two different directions, viz., *outwards* and *inwards;* the former kind of displacement is much more common than the latter. These dislocations may be complete or incomplete; in the first the cap leaves the joint-surfaces of the thigh-bone, and rests on one or other protuberance; in the second it still partially touches the corresponding surface. *Diagnosis* of dislocation of the knee-cap is always easy; the limb is outstretched; and if it be attempted to bend the leg, the pain is increased; the knee has lost its natural form. In

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(*a*) Révue Médicale, April, 1835.

(*b*) Annales d'Hygiène publique; in **Froriep's** Notizen, No. 122.

(*c*) Journal des Connaissances Medico-Chirurgicales, May 1838, p. 180.

(*d*) P. **Humbert** and N. **Jacquier**, Essai et Observations sur la manière de réduire les Luxations spontanées ou symptomatiques de l'Articulation ileo-fémorale; méthode applicable aux luxations congénitales et aux luxations anciennes par cause externe. Paris, 1835; with Atlas of 20 plates.

(*e*) Ueber spontane und congenitale Luxationen, so wie über einen neuen Schenkelhals-Bürch-Apparat. Stuttgardt, 1842.

(*f*) Gazette Médicale de Paris, 1841. No. 7–10.

(*g*) Bulletin de l'Académie Royale de Médecine, vol. vii. p. 5.

(*h*) A. **Sanson**; in Rév. de Spécialités, 1841, Feb. —Journal de Médecine de Lyon, 1841, Nov. p. 381.

dislocation *outwards* the prominence of the inner condyle is felt through the skin, and upon the outer condyle, and if the dislocation be complete on its outside, a considerable swelling is produced by the knee-cap. In dislocation *inwards*, the outer condy leis felt and the prominence of the knee-cap on the inner condyle. This dislocation is nearly always incomplete.

Coze's observation of a dislocation of the knee-cap, in which it was half twisted round itself, has been denied (*a*).

Wolf (*b*) has noticed a complete twisting round of the knee-cap.

1084. The causes of dislocation of the knee-cap are mostly, external violence acting on the bone in moderate bending, or complete straightening of the leg, and after driving it to one or other side. Also any circumstance by which the foot is turned outwards whilst the knee turns in, may produce this dislocation. If the ligaments of the knee-cap be very relaxed, or the condyles of the thigh little prominent, this dislocation may be produced by slight causes.

In general, dislocations of the knee are not dangerous; but when the violence producing them acts very severely upon the knee-joint serious symptoms may be caused by the contusion.

1085. In *reducing* this dislocation, which cannot always be effected at the first attempt, the patient should be laid upon his back, the leg straightened as much as possible, and the thigh bent at the hip-joint, the knee-cap is then to be pressed directly forwards, and when its great ridge is lifted over the edge of the condyle, it is drawn into place by the action of the muscles. The knee should be enveloped in cloths dipped in a dispersing wash; and the patient kept quiet in bed till the pain and swelling have ceased. Should the knee-cap be disposed again to be dislocated, the knee must be supported by means of an elastic knee-bandage.

I have seen a *congenital dislocation* of the knee-cap on both sides, in an aged man. The knee-cap rested entirely on the outer side, so that the middle of the knee-joint was completely void. The knee-cap was so movable, that in the straight position of the leg it could easily be brought to its proper situation, but on the slightest movement was again displaced. Both knees were very much twisted inwards, the legs and feet very much outwards. The man's gait was very difficult and unsteady. **Palletta** (*c*) has examined a case of congenital dislocation of the knee-cap.

XII.—OF DISLOCATION OF THE KNEE-JOINT.

(*Luxatio Genu*, Lat.; *Verrenkung des Kniees*, Germ.; *Luxation de Genou*, Fr.)

von **Siebold's** Chiron., vol. i. p. 33.

Boyer, above cited, vol. iv. p. 365.

Cooper, A., above cited, p. 184.

1086. Dislocations of the knee are rare, on account of the great strength of the joint. The shin-bone may, however, be displaced forwards, backwards, and to one side or other from the joint-surfaces of the thigh-bone. These displacements are mostly incomplete. The ligaments and tendons which strengthen the knee are always in these dislocations, either much torn or much stretched; even the vessels and nerves may be torn, or the joint-ends of the bones thrust out through the skin. These dislocations cannot be mistaken, on account of the projections which the shin-bone and condyles of the thigh form in opposite directions.

(*a*) Mém. de la Société d'Emulation. Paris, 1826, vol. xviii.

(*b*) **Rust's** Magazin, vol. xxvii. p. 476.

(*c*) Exercitationes Pathologicæ, p. 91.

1087. The *reduction* of these dislocations is not usually accompanied with difficulty. Sufficient extension of the leg is made, and then the displaced joint-end of the shin-bone is pressed into its place, one hand grasping it, whilst the other has hold of the lower end of the thigh-bone. After the reduction, inflammation must be prevented or got rid of, and the union of the ligaments effected, by strict antiphlogistic treatment, and by keeping the limb quiet, fastening it up in a pair of splints. When all swelling and pain have subsided the limb may be cautiously moved. If the joint remain weak, volatile rubbings must be employed, and a knee-band used for some time to give support. If the inflammation be severe, *anchylosis*, suppuration, gangrene, and so on, may take place, and the treatment must be guided according to the rules laid down for wounds of joints. If the joint-ends of the bones be thrust through the skin, there may be such destruction, that immediate amputation is requisite. Single cases in which the preservation of the limb is possible cannot refute these principles.

If the ligaments connecting the semi-lunar cartilages with the shin-bone be relaxed, they may by external violence, by pushing with the toes of the outward-turned foot and so on, remove the semi-lunar cartilages from their position. At the same time severe pain, swelling, incapability of stretching out the foot, without much alteration of form in the knee come on. The natural position of the cartilages is most certainly restored, when the leg is bent back as much as possible, by which the pressure of the thigh-bone on the semi-lunar cartilages is removed, and they return to their place, when the leg is extended. The weakness of the joints is to be removed, by volatile rubbings and the like, and the recurrence of this accident prevented, by a properly applied knee-band (ASTLEY COOPER.)

WUTZER (*a*) observed a *congenital* bending forwards of both legs, depending on dislocation at the knee-joint. KLEBERG (*b*) describes a *congenital* dislocation of the left knee forwards, where, with the thigh extended, the leg was bent forward at the knee, and lay obliquely upwards in such way, that the points of the toes touched the right side of the belly; the legs could be easily returned to their natural position; they, however, immediately resumed their previous position, whilst the child himself had not any voluntary influence over their movements. Bending the leg back against the thigh to an obtuse angle, and fixing it in this position, by a thin cloth passed round the middle of the thigh and leg, in a short time restored the natural position and mobility of the leg.

XIII.—OF DISLOCATION OF THE SPLINT-BONE.

(*Luxatio Fibulæ*, Lat.; *Verrenkung des Wadenbeines*, Germ.; *Luxation du Péroné*, Fr.)

BOYER, above cited, vol. iv. p. 375.

1088. The *splint-bone* may be dislocated at its upper or lower end, *forwards* or *backwards*. This can always be readily distinguished, as the head of the bone can be felt if there be not any considerable swelling.

In order to *reduce* this dislocation, it is only necessary to press the dislocated head into its place, and to fix it there with compresses and bandages. The dislocation of the upper end may be accompanied with fracture of the shin-bone, in which with the reduction of the fracture follows also that of the dislocation. Not unfrequently, owing to relaxation of the ligaments, dislocation of the upper end of the splint-bone takes place; its reduction in this case is easy, but just as speedily does the displacement recur. The bone is to be kept in place by rest, and by fixing it with bandages; the weakness of the joint should be sought to be removed by friction, blistering, and the like.

(*a*) MÜLLER's Archiv. für Anatomie und Physiologie, 1825, pt. iv. p. 385.
(*b*) Hamburger Zeitschrift, vol. vi. pt. ii.

XIV.—OF DISLOCATION OF THE ANKLE-JOINT.

(*Luxatio Tali*, Lat.; *Verrenkung des Fussgelenkes*, Germ.; *Luxation du Pied*, Fr.)

Desault, above cited, vol. i. p. 423.

Boyer, above cited, vol. iv. p. 375.

Cooper, Astley, above cited, p. 238.

Dupuytren; in Annuaire Medico-Chirurgical des Hôpitaux et Hospices de Paris. Paris, 1819. 4to.; with copper-plates.

1089. Dislocations *of the foot* are frequent, and may occur *inwards* and *outwards*, *forwards* and *backwards*; the dislocation inwards is the most common; those forwards and backwards are much rarer than those on either side. They are generally complete or incomplete, simple or compound.

1090. In the dislocation *inwards*, produced by violent turning of the foot outwards, the joint surface of the *astragalus* is placed beneath the inner ankle, and the lower end of the shin-bone so thrust inwards, that the skin is ready to burst by its pressure; the inner edge of the foot is inclined downwards, the outer upwards, the sole of the foot outwards and its back inwards. This dislocation may be accompanied with considerable tearing of the ligaments, with fracture of the outer ankle or of the middle of the splint-bone, or of the lower end of the shin-bone, the soft parts may be torn, the joint surface of the *astragalus* or of the shin-bone be thrust through the skin, or there may be at the same time dislocation of the *astragalus* from its connexion with heel- and navicular bones. In the latter case, the integuments are often uninjured, and the ligaments between the *astragalus*, heel-, and navicular bone suffer only considerable extension; often, however, are all these ligaments and integuments so torn, that the *astragalus* is merely attached at some parts.

The dislocation *outwards*, is consequent on violent inclination of the foot inwards; the *astragalus* is thrust beneath the outer ankle, the inner edge of the foot is turned upwards, the outer inwards, the sole inwards, the back outwards. This dislocation may be connected with fracture of the lower end of the splint-bone and of the inner ankle. Usually is there also in lateral dislocation, a more or less decided inclination of the foot forwards or backwards.

1091. The symptoms mentioned of lateral dislocation are so distinct that it cannot be mistaken even when considerable swelling has taken place. But this swelling may render difficult the *diagnosis* of the different complications.

1092. In dislocation of the foot *forwards*, which arises from violent extension of the foot, and is rarer than that backwards, the joint-surfaces of the *astragalus* are in front of the shin-bone, the foot fixedly bent, the heel shortened, and the Achilles' tendon nearer the back of the leg.

In dislocation *backwards*, which may be consequent on a fall, with the sole of the foot on an oblique surface, the foot is outstretched and shortened, the heel more prominent, the Achilles' tendon projects from the back of the leg, the joint-surface of the *astragalus* is felt on the back of the shin-bone, the under end of which forms a hard projection on the middle of the instep and rests on the navicular bone and only on a small portion of the articular surface of the *astragalus* in front. This dislocation is always accompanied with fracture of the splint-bone of the inner ankle, or the latter is torn off.

This dislocation may be incomplete, so that the shin-bone rests half upon the navicular, whilst the other half remains on the *astragalus*. The foot then seems but little shorter, the heel projects a little, the toes are pointed downwards, so that the patient cannot put the whole sole of the foot on the ground, the heel is drawn up, and the foot to a great extent immovable; the splint-bone is broken.

1093. Dislocations of the foot are always important, because they presuppose great violence; and severe inflammation, and dangerous symptoms ensue from the tearing of the ligaments and from the dragging of the tendons and soft parts. Even in slighter degrees, stiffness of the joint is to be feared. There often remains so great weakness of the ligaments of the joint that the dislocation is reproduced by the slightest effort, if the joint be not strengthened by some mechanical apparatus. The dislocations forwards and backwards, are generally less dangerous, than the lateral dislocations and rarely accompanied with evil complications. Even if the dislocation be not reduced, the foot is not completely unfit for use; but very considerable deformity remains. Lateral dislocations are not always equally dangerous; they often are soon cured without any weakness or interference in the motions of the joint remaining. Dislocation outwards is mostly accompanied with more injury than that inwards. Simultaneous fracture of bones or tearing of soft parts render the case so much more dangerous; though experience shows that, in most cases, the limb may be preserved.

1094. The *reduction* of dislocation of recent occurrence, is usually not very difficult. The patient lies down, one assistant grasps with both hands the lower part of the shin-bone, and another, or in dislocation aside the Surgeon himself takes hold of the foot. The former makes counter-extension in the direction of the shin-bone, the other extension, (in which the leg is bent at right angle on the thigh,) first in the direction which the foot had, and when the ligaments and tendons are sufficiently stretched, he brings the foot into its proper place. In dislocations *backwards*, the Surgeon with one hand presses the heel forwards, and with the other the shin-bone backwards, and the contrary in dislocation *forwards*. Complete reduction is indicated by the natural direction and form of the foot and its capability of motion. The ankle-joint should then be enveloped in linen, dipped in dispersing fluid, and fastened with a circular bandage applied in a figure of ∞ form. Chaff bags are to be applied on each side of the leg and splints upon them which extend over the ankle-joint as in fracture of the leg. The leg must always be bent at the knee-joint, and laid on a cushion, to relax the muscles. Antiphlogistic treatment must be employed proportionate to the constitution, the dressings moistened with dispersing fluid, and replaced every five or six days. When the pain and swelling have subsided, careful motion must be used, but only after a month, may the patient be allowed to walk gently about.

If dislocation of the foot *inwards*, be accompanied with fracture of the splint-bone, its re-dislocation is most effectually prevented by the apparatus used for fractured splint-bone, which may be also applied in dislocation *outwards*, the splint with the chaff bag being put on the outside of the leg. In dislocation of the foot *backwards*, re-displacement may be prevented by placing a splint and cushion beneath it, (so that both project beyond the heel,) and a small cushion on the lower part of the shin-bone, which is here, as well as at the knee, to be fastened with a bandage (*a*). In dislocation aside, many persons recommend, that the limb should be laid on its outside, with the leg bent, and the foot enveloped in the many-headed bandage.

[Sometimes in dislocation of the ankle-joint inwards, the internal lateral ligament is torn through without the malleolar process being broken off. This is a rare accident, and very difficult to keep in place if there be any disposition to spasm, of which there is an example in a case of Henry Earle's (*b*). The splints were consequently applied more tightly, and perhaps from that cause irritation set up, which terminated in abscess, which was twice opened. The soft parts about the ankle-joint became sloughy, and the patient's violent efforts, whilst delirious, thrust the bone through the mortified skin, and it could no longer be at all kept in place. Amputation was performed, but the case terminated fatally.]

1095. If in dislocation of the foot, the joint-end of the shin-bone be driven through the integuments, so soon as it has been properly cleansed, its replacement must be attempted, the wound carefully closed, and the treatment conducted after the general rules. If the narrowness of the wound prevent the reduction, it must be sufficiently enlarged; and if it cannot be then effected, the projecting bone must be sawn off, whereby, alone, the natural position of the foot can be restored, and dangerous symptoms prevented. Amputation is only inevitably necessary, in old weakly persons, in very extensive tearings and crushings of the bones, on the occurrence of mortification and wasting suppuration. If in dislocation *outwards*, the shin-bone be broken obliquely, near its joint surface, it cannot be kept in place after reduction, and amputation may be indicated. It may also be necessary in cases of continuing very troublesome deformity.

[In compound dislocation of the ankle-joint, with protrusion of the shin-bone through the wound, most English Surgeons saw off the joint end, not merely to render reduction more easy, but also, according to Astley Cooper's opinion, to lessen the suppurative process, by diminishing the synovial surface. This mode of practice is certainly not commonly followed in reference to other joints, and the younger Cline was always opposed to it being resorted to in dislocated ankle. It must however be admitted, that Cooper's reasoning as well as practice favours the proceeding.—J. F. S.]

XV.—OF DISLOCATIONS OF THE INSTEP-BONES.

(*Luxatio Tarsi*, Lat.; *Verrenkung des Fusswurzelknochen*, Germ.)

1096. The connexions of the bones of the instep are so firm, partly from the strength of their ligaments, and partly from the broad surfaces by which they touch, and their motions are so confined, that their dislocation is extremely rare, and only possible from very great violence, therefore, also commonly accompanied with tearing of the soft parts.

1097. *Dislocation of the Astragalus* may, notwithstanding its situation in the hollow formed by the shin- and splint-bones, and its firm fastening to the heel- and navicular bones, occur in four different directions, in which it may be thrown *forwards*, *inwards*, or *outwards*, from its connexion with the navicular, or it may be *so twisted on its axis*, that its under joint surface is turned upwards. The dislocations forwards and inwards are more common than that outwards (1). These dislocations may be connected with fracture of the shin- or splint-bone, with dislocation of the foot, with tearing of the soft parts and protrusion of the head of the *astragalus*. The cause is violence, which displaces the foot and leg at its greatest degree of extension, as in a fall from a height, when the sole of the foot lights on an oblique surface, and the body falls backwards; or a

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(*a*) Dupuytren, above cited.—Chirurgische Kupfertaf. Weimar, 1820, pt. ii. pl. vi. fig. 5.

(*b*) Medical Gazette, vol. iv. p. 61. 1829.

fall of the body backwards, whilst the fore part of the foot is fixed, so that the shin-bone is brought into a nearly straight direction with the foot. In this position, the lower end of the shin-bone presses on the back of the *astragalus*, drives it forwards, and tears the astragalo-tibial ligament, and lets go the head of the *astragalus* from the hollow of the navicular bone. It is therefore intelligible, why dislocation does not occur when the shin-bone breaks, and this dislocation takes place, especially in powerful, healthy persons, whose bones are strong. In dislocation *inwards*, indeed, there is always fracture of the lower end of the splint-bone. Most probably the head of the *astragalus* is always primarily dislocated forwards from the navicular bone, and driven according to the direction of the operating force, inwards or outwards. In *twisting round* of the *astragalus on its axis*, it must be driven from behind, forwards, and from below, upwards, with a very great thrust of the shin-bone upon the foot and leg, whilst extended to the utmost, with which the skin yielding, indeed, though resisting, and the inter-osseous ligament must be torn through.

(1) When Rognetta supposes that dislocation of the *astragalus inwards*, if not impossible, yet is in the highest degree difficult, because the cleft between the navicular bone and *astragalus* is filled by exceedingly strong ligaments, the capsule between the two bones in front too weak and extensible, and because the violence causing the dislocation must operate from before backwards; this can only follow on the *primary* dislocation of the head of the *astragalus*, as the cases, known to the present time, show greater frequency of the dislocation inwards, than of that outwards. In his experiments, Rognetta has never been able to produce any other dislocation of the *astragalus* than that forwards.

[The dislocation *outwards* is very rare; besides James's, of Croydon, case (*a*), and two other under Guthrie's care (*b*), I know of none save one now under my friend Stanley's care in St. Bartholomew's Hospital, and which had occurred in consequence of the young man slipping off the fourth round of a ladder, the appearances of which corresponded very closely to the description given by Astley Cooper, but there is not any fracture of the splint-bone. Violent attempts had been made for its reduction before his admission into the hospital some days after the accident, but, as in the other three cases, without success. Reduction was also attempted two or three days after his admission into St. Bartholomew's, but they also were quite unavailing, and the displacement still remains.

Of these cases, James's was the only one in which there was fracture of any bone, and in that the inner *malleolus* was broken obliquely.—J. F. S.]

1098. In dislocation of the *astragalus forwards*, the projection of the head of that bone upon the navicular, is felt on the instep, the toes are depressed and turned somewhat outwards. In the dislocation *inwards*, the projection is more to the inner side, and the toes turned more outwards (1); and in dislocation *outwards*, the prominence of the head of the *astragalus* upon the cuboid bone, and the foot is so turned inwards, that the outer edge is directed downwards, and its inner, upwards. With much swelling the diagnosis is difficult, and even impossible (Boyer.) If the soft parts be at the same time torn, the head of the *astragalus* either protrudes or may, with the finger, be felt bared. In dislocation of the *astragalus*, *with twisting on its axis*, it may be so locked in between the shin-bone and heel-bone, that the limb appears longer. If, however, this be not always the case, this sign is extremely important, in order to suspect such dislocation, and always to avoid, in such cases, useless and prejudicial attempts of extension and counter-extension (Rognetta.)

(1) The younger Cline's case of simple dislocation; and Green's case of compound dislocation inwards (*c*).

(*a*) Cooper, above cited, p. 359.

(*b*) Hancock's Paper; in Med. Times, vol. ii. 1844, p. 71.

(*c*) A. Cooper, p. 364.

1099. Every complete, although simple dislocation of the *astragalus*, is of great consequence, as its *reduction* is often very difficult, frequently quite impossible, and, in that case, a great degree of lameness remains; or by the stretching of the integuments a slough is formed, which only rarely remains superficial, without opening the joint, (DUPUYTREN,) but mostly after its separation lays bare the joint, in consequence of which, severe inflammation, extensive suppuration, slough, and dangerous symptoms, are produced, and even amputation may be rendered necessary (BOYER.) Only when the dislocation of the head of the *astragalus* is not complete, can the function of the foot be gradually to some extent be restored, if reduction has not been effected (DUPUYTREN, BOYER.) In compound dislocation the danger is still greater, and depends on the kind of complication.

The impossibility of reducing dislocation of the *astragalus*, even by treatment accompanied with the greatest care and force, as observed by BOYER, ASTLEY COOPER, DUPUYTREN, myself, and others depends on the firm locking of the neck of the *astragalus* between the other bones. In the dislocation *inwards*, the neck of the *astragalus* is so locked in between the inner edge of the navicular and heel-bone, that it is completely immovable, or when the hinder under edge of the upper-joint surface of the *astragalus* lies under the front edge of the shin-bone, as DUPUYTREN once observed. In dislocation *outwards*, the head of the *astragalus* may be found beneath and a little before the outer ankle, and its neck pressed on the edge of the hind-joint-surface of the heel-bone, or the head of the *astragalus* rests upon the cuboid and outer cuneiform bones; the outer edge of the upper-joint surface of the *astragalus* is placed between the first hinder-joint-surface of the heel-bone, and the shin-bone; on which account it is impossible to free the *astragalus* by the ordinary methods of reduction.

[The simple dislocation *outwards*, from the cases already mentioned, may be presumed to be irreducible.—J. F. S.]

1100. The reduction of dislocated *astragalus*, in which it must not be forgotten to diminish the contraction of the muscles, in powerful subjects, by blood-letting, *nausea*, and so on, always require bending the leg at the knee-joint. Two assistants fix the thigh, or a folded cloth is for this purpose carried round beneath the knee, and fastened to a hook behind the patient. Other two assistants fix the leg above the ankle. A folded cloth is to be applied round the heel, carried over the instep, and crossed, without covering the projecting bone, and its ends given to assistants to make extension. The extension must be made gradually and strongly, in the direction which the foot has; the Surgeon places the fingers of both his hands upon the sole of the foot, and the thumbs upon the projection of the *astragalus*, which he presses back. This pressure may be practised with the flat of the hand, or whilst with the one hand he grasps the leg, and with the other the toes, he places his knee against the projecting *astragalus*, and thrusts it back (PETRUNTI.) If the reduction be effected, the leg is to be placed half-bent, upon a chaff bag, and retained by the apparatus used for fractured splint-bone, (*par.* 703,) in a position contrary to the direction of the dislocation. The inflammatory symptoms are to be prevented, or got rid of, by strict rest, cold applications, and so on.

1101. If the reduction be not possible, the attempts to effect it are not to be carried too far, because thereby undoubtedly, severe inflammation and danger of gangrene will be produced; but the *astragalus* must be laid bare by a semilunar incision, of which the convexity is directed upwards, the firmly attached parts of the ligaments divided with the knife or scissors, and the reduction then attempted; after which the wound is to be closed with sticking plaster. If the replacement be impossible, it is best to remove the *astragalus* entirely, seizing it with the fingers, or with the forceps, and separating its connexions with a bistoury or curved scissors, in which we must keep on the outside specially for the division of the interosseous ligaments. The wound is to be brought together with sticking plaster, or lightly covered with lint, and the foot and leg kept in a proper position by SAUTER's or EICKHEIMER's apparatus. The joint-surfaces of the shin-bone are to be brought in contact with the heel-bone. The cure follows, although with shortening, yet with proper usefulness of the foot, so that the patient can gradually walk without difficulty, as I myself noticed in one case. If, after fruitless attempts at reduction, gangrenous inflammation, suppuration, and the like ensue, the removal of the *astragalus* is the only remedy, by which these dangerous unexpected symptoms may be easily got rid of, as thereby both the experience of others, as well as my own, prove the seemingly necessary amputation may be avoided.

1102. If the *astragalus* be twisted on its axis, and at the same time dislocated from its connexion with the shin-bone, the heel-bone, and navicular-bone, every attempt at reduction is actually useless, and the removal of the *astragalus* is the only way to preserve the foot.

Although many observations have been published in which extirpation of the *astragalus* has been performed with the most perfect success, when the skin had been destroyed by gangrene, or the dislocated bone had been loosened by suppuration, the early extirpation of the bone seems most proper, because thereby manifestly dangerous symptoms can be prevented. It is scarcely necessary to remember that in this extirpation the injury of the tendons, nerves, and vessels should be most carefully avoided, and every bleeding vessel tied at once.

Upon dislocations of the *astragalus* compare—

DESAULT, above cited, vol. i. p. 435.

BOYER, above cited, vol. iv. p. 388.

ASTLEY COOPER, p. 376.

ROGNETTA, in Archives générales de Médecine, 1833, Dec., p. 485.

1103. The *heel-bone* may, as a consequence of a fall on the heel, or other violence, be dislocated *outwards* from its connexion with the *astragalus* and cuboid bone. The great deformity of the heel is the ground of this *diagnosis*. The bone must be pressed back into its place, and there retained by proper apparatus.

As the consequence of an old dislocation of the heel-bone which had been produced in early life by violent dragging off a boot, I have observed degeneration like *elephantiasis* and enlargement of the leg which rendered amputation necessary (*a*).

[The two cases of dislocation outwards of this bone, mentioned by ASTLEY COOPER, were from my notes. In the *simple* dislocation, (MARTIN BENTLEY,) the tuberosity of the heel-bone had nearly disappeared, but the outside of the bone projected on the outer side of the foot much beyond the outer *malleolus*, immediately beneath which however was a remarkable depression. On the inside there was a remarkable and unnatural projection, caused by the head and inside of the *astragalus* directly below the inner *malleolus*; the whole foot was displaced outwards and the toes turned out. These appearances must have resulted from the *astragalus* having been dislocated inwards, from both heel and navicular bone, so that its under joint-surfaces rested on the inner edge of the heel-bone. The dislocation was easily reduced, having bent the thigh and knee on the body and fixed the leg, by laying hold of the *metatarsus* and of the tuberosity of the heel-bone, and drawing the foot gently and directly from the leg, during which extension CLINE put his knee against the outside of the joint, and the foot being pressed against it, the heel and navicular bones readily slipped into their place and the deformity disappeared. In the *compound* dislocation, (THOMAS GILLMORE,) a

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(*a*) Heidelb. klinische Annalen, vol. ii. p. 354.

wound extended from opposite the middle of the base of the shin-bone, round the upper part of the instep to the outer malleolar process, exposing the head of the *astragalus* in front, and its outer under-joint-surface for the heel-bone on the outside; the latter and the navicular bone, together with the whole foot, were carried in, so that the toes pointed much inwards towards the opposite foot, whilst the tuberosity of the heel-bone projected outwards. It was reduced by extending the foot and rotating it outwards.

In HANCOCK's case (*a*) which seems to have been a simple dislocation of the heel and navicular bones outwards, but which was not reduced for a week, the skin which had previously vesicated, sloughed, and as the slough cleared off, the internal calcaneo-scaphoid ligament sloughed also, and the head of the *astragalus*, which had previously kept its place, twisted round on the heel-bone, till a large portion of its head protruded through the wound, and having lost its articular cartilage and become dead, about three quarters of an inch of it were sawn off, and then the wound healed.—J. F. S.]

1104. The *navicular* and *cuboid bones*, though remaining connected with the cuneiform, may be dislocated from the *astragalus* and heel-bone, which can only be effected by great violence, as the fall of a heavy weight upon the foot. The *astragalus* and heel-bone remain in their natural place, but the fore part of the foot is always twisted inwards, as in club-foot. Fixing the leg and heel, and extension of the foot outwards, effect reduction.

[A case is mentioned (*b*) of a bricklayer's boy, aged fourteen years, who fell down a height of forty feet, and apparently struck the extremity of the foot. The ligaments on the dorsal surface of the foot appear to have started, and the scaphoid and cuboid bones projected a little upwards out of their places. The foot was much swelled, was about half an inch shorter than the other, and had a clubbed appearance. Nothing was done in this case.]

1105. Dislocation *of the cuboid bone* may, as a consequence of great violence, occur *upwards*, according to PIEDAGNEL, also *inwards* and *downwards*. The irregularity and prominence at the situation of the dislocated bone, its form, and the altered direction of the fore part of the foot, give cause for *diagnosis*, and distinguish it from a dislocation of the head of the *astragalus* upon the navicular bone; as here especially the smoothness and convexity of the head of the *astragalus* and the three joint-surfaces of the navicular bone lead to it. The leg and heel should be fixed, the extension of the foot made in the outward direction, and the bone pressed into place with both thumbs, after which the foot is to be laid on its side, and protected with a proper apparatus. If the reduction cannot be effected, destructive suppuration and *caries* ensue, and the extirpation of the bones is necessary (PIEDAGNEL) (*c*).

1106. The *great cuneiform bone* may be dislocated by tearing of the ligaments which connect it with the middle cuneiform, the navicular, and the metatarsal bone of the great toe; it is then projected considerably inwards and somewhat upwards, by the action of the *m. tibialis anticus*, and does not correspond with the straight line of the metatarsal bone of the great toe. It must be attempted by pressure to return the bone to its natural place, where it is to be kept by compresses, and a bandage applied round the foot and moistened with a dispersing lotion. When the inflammation has subsided, a leathern strap should be bound around the foot, till the ligaments have united.

ASTLEY COOPER (*d*) describes two cases of this dislocation, in both of which the bones were not replaced; there remained, however, only little detriment.

1107. Dislocation *of all the metatarsal bones* from their connexion

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(*a*) On Dislocation of the *Astragalus* with the lower ends of the *Tibia* and *Fibula*; in Lancet, vol. ii. p. 35. 1844.

(*b*) Lancet, vol. i. 1839–40, p. 133.

(*c*) PIEDAGNEL; in Jour. Univers. et Hebdom., vol. ii. No. 19.

(*d*) Above cited, p. 383.

with the first row of the instep-bones, in consequence of a fall backwards or forwards, whilst the fore part of the foot was fixed, has been observed by **Dupuytren** (*a*). The foot is shortened from four to eight lines by the pushing of the bones upon one another; the arching of the top of the foot is destroyed, the hinder end of the first metatarsal bone forms a projection of half an inch across, behind which is a deep hollow; the concavity of the sole is completely destroyed; the extensor tendons are to be felt distinctly, and the toes are raised by their stretching; the movements of the foot are impossible.

Reduction is effected by fixing the leg when bent, by pulling at the front of the foot with a slip knot, and by pressure on the displaced bones. The foot is then to be laid on one side, and when inflammation has ceased, it should be kept steady in a proper apparatus.

[A case of dislocation of the outer two metatarsal bones from the cuboid was admitted in 1835 at St. Thomas's, under my friend **Green's** care. The patient had received a violent blow by the falling of a heavy chest upon the inside of the foot. Upon the top of the foot there was a large swelling before and below the outer ankle, and behind it a cavity in which two fingers could be easily buried, in consequence of the bases of the metatarsal bones having been thrown upwards and backwards upon the top of the cuboid. At the base of the metatarsal bone of the great toe, where the blow had been received, was a swelling as large as a walnut, dependent, however, only upon effusion without displacement or fracture. The dislocated bones were reduced by continued extension with much difficulty, and as they recovered their place a distinct crackling was heard.—J. F. S.]

1108. Dislocation *of the Toes* rarely occurs, and to it applies all that has been formerly said in reference to dislocated fingers. Dislocation of the *great toe* from the corresponding metatarsal bone occurs most frequently in consequence of a fall or hanging in the stirrup. It is either incomplete with a painful projection of the lower end of the metatarsal bone, or complete with tearing of the capsule of the joint, of the tendons, of the skin and accompanied with projection of the end of the bone. Its *reduction* is performed by fixing the foot and extending the toe with a slip knot. If there be also a wound, it must be properly closed with sticking plaster, and inflammation prevented especially by perfect rest, cold applications and suitable treatment. If reduction cannot be effected, the projecting end must be sawn off, and the bone kept in its proper place by a suitable apparatus. Only in splintering of the bone and great destruction of the soft parts is amputation or disarticulation of the corresponding metatarsal bone necessary. If an incomplete dislocation remain unreduced, great difficulty in walking, continued pain and inflammation of the skin, which it excites, may indicate the laying bare of the projecting end of the bone by a longitudinal cut, and its removal, in which the tendon is to be pushed aside.

Astley Cooper (*b*) observed an old simultaneous dislocation of the four lesser toes from their connexion with the corresponding metatarsal bones, by which the functions of the foot were in a great degree destroyed.

(*a*) Révue Médicale, Dec. 1822.—Heidelberg. klinische Annalen, vol. iv. pt. iv.

(*b*) Above cited p. 385.

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